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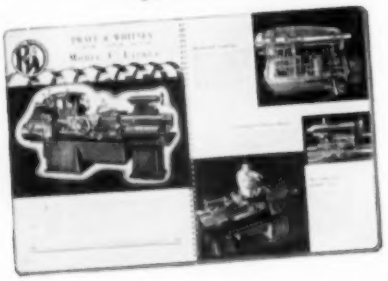

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THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

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TABLE OF CONTENTS

		Page
Editorial—Integration . . . the Way to Greater Achievements	*by A. M. Sargent*	17
Tooling for Fabricating Stainless Steel at The Budd Company	*by John C. Whitesell*	18
Cemented Hard Carbide Compositions	*by Philip M. McKenna*	23
Organization of Quality Control as a Management Tool	*by T. D. Foy*	27
Water Wash Spray Booth Operation	*by Fred M. Burt*	29
Production Unlimited	*by A. M. Sargent*	32
Master Tooling Dock for Aircraft	*by Karl Stadt*	35
The Role of Standards in the System of Free Enterprise	*by Howard Coonley and P. G. Agnew*	36
The Case for Fundamentals	*by E. H. Wheeler*	40
Reviews and Previews	*by Fred W. Steiner*	42

DEPARTMENTS

Gadgets	44
Fundamentals of Tool Engineering	45
A.S.T.E. News	47
Andygrams	55
Bulletins	56
Good Reading	57
Tools of Today	58
North, East, West, South in Industry	70
Index to Advertisers	142

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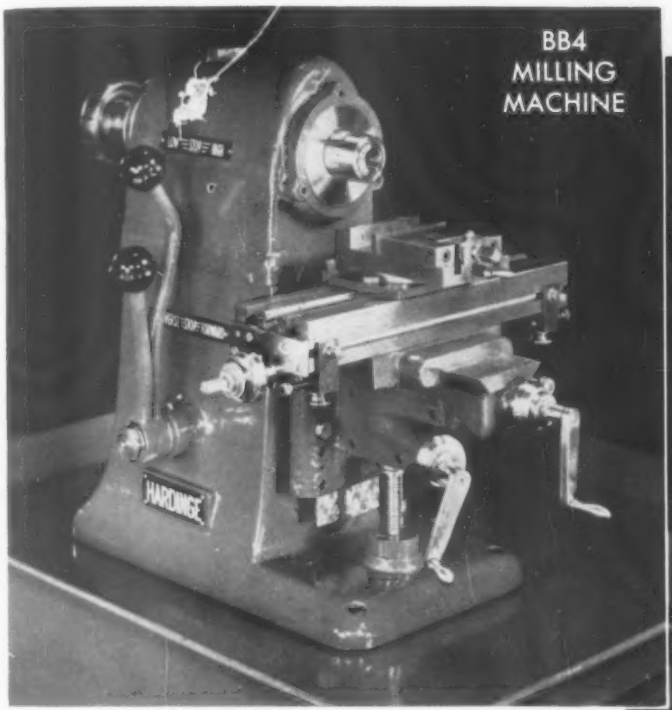

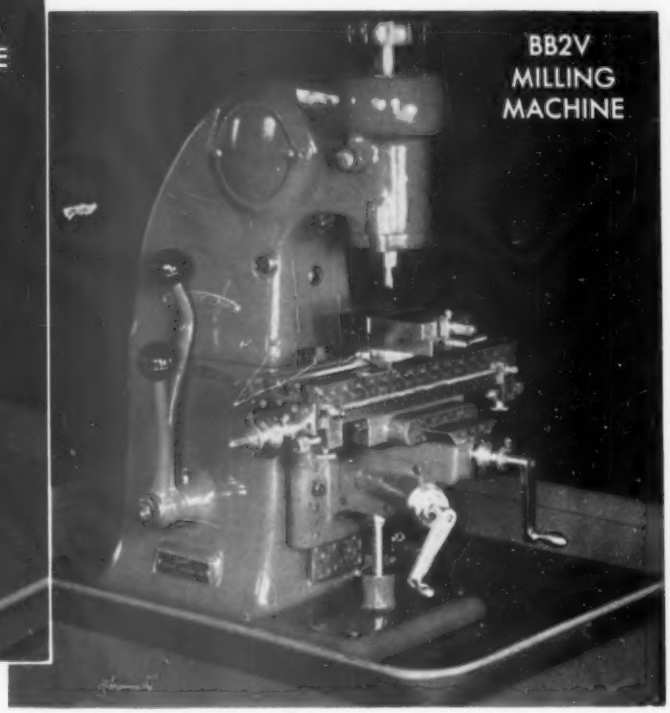

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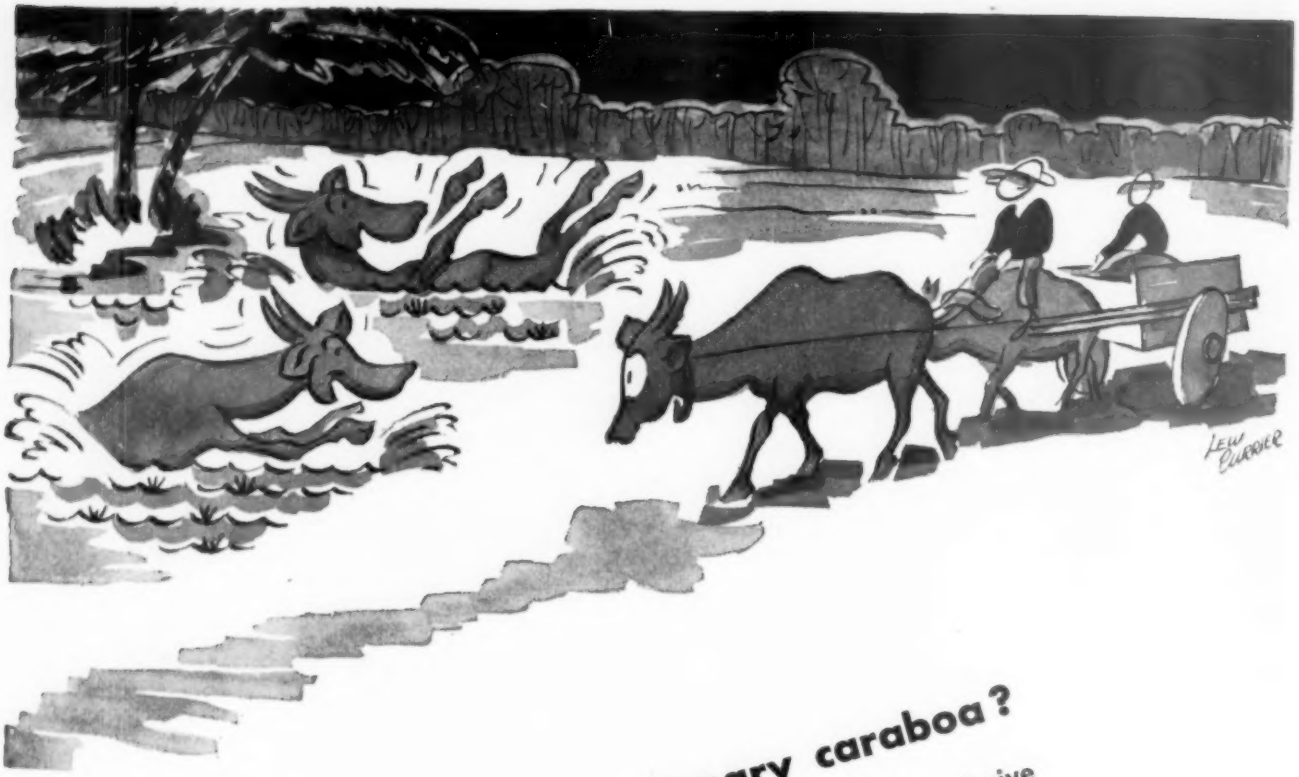

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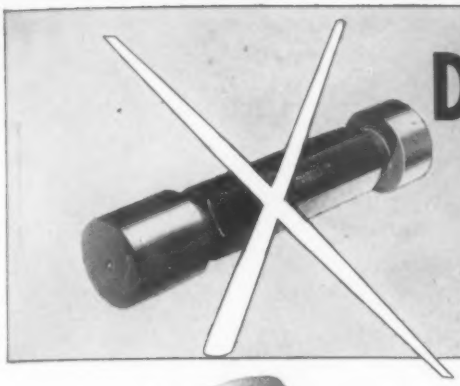

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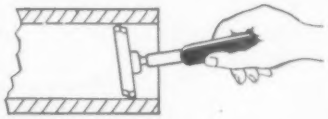

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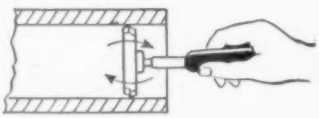

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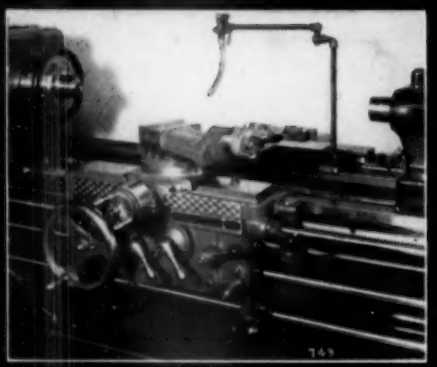

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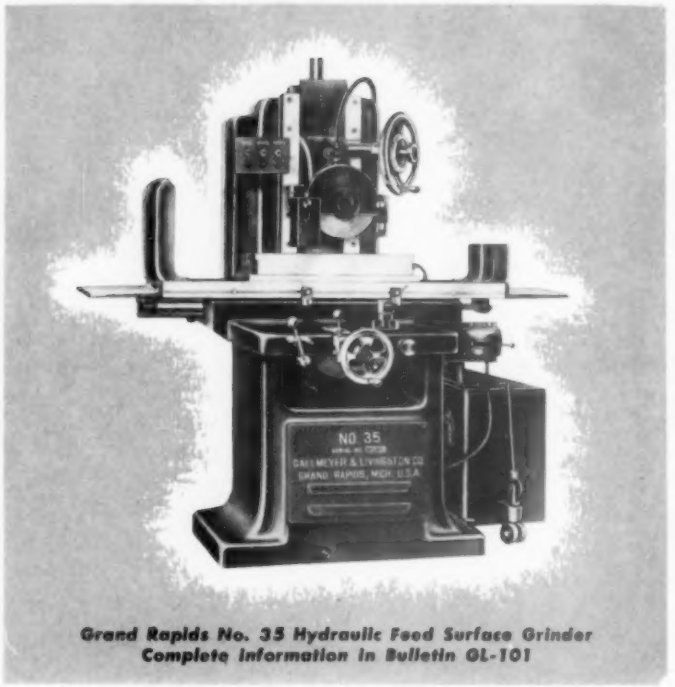

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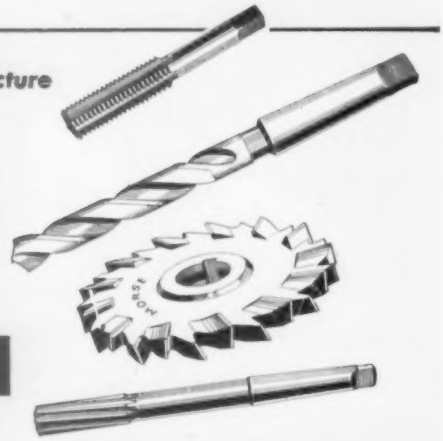

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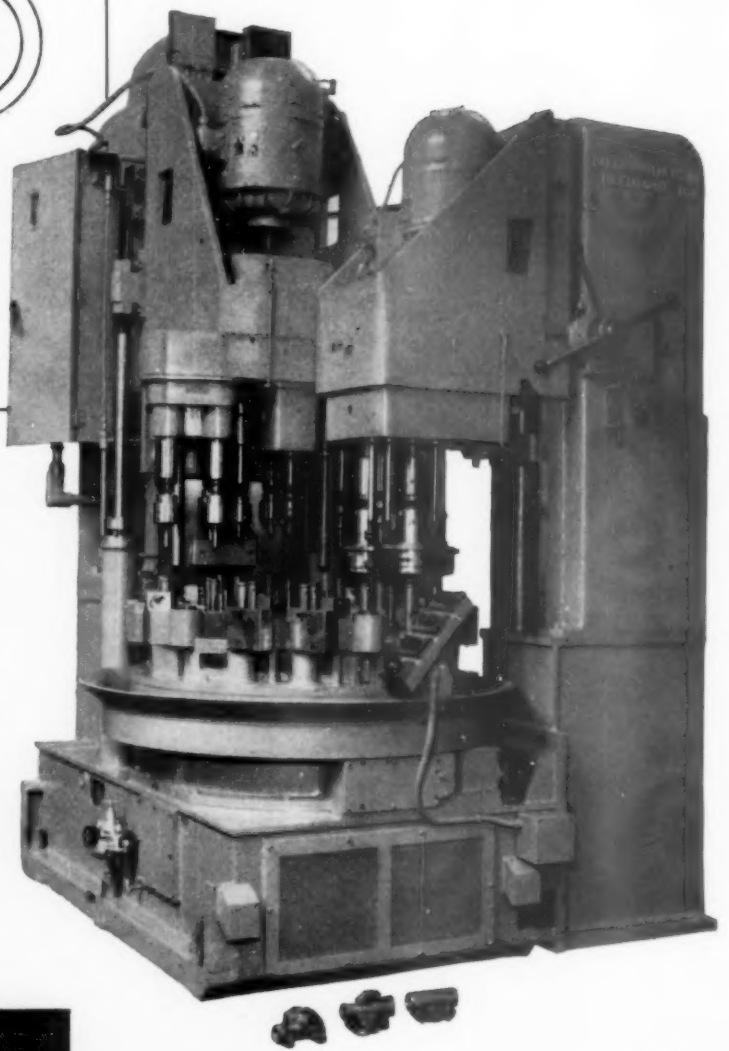


The work—a shock absorber body. The machine—a Baker 36HO with Multi-Spindle Head. The result—*increased productivity!*

Both ends of shock absorber body are mat cast iron. The work is rough and finish turned, ends serrated and chamfered. (These operations from standard 36HO machine). Ends threaded at last station under a 4 spindle special threading unit. All 4 spindles of threading unit with individual lead screws and nuts. Reversing two speed motor drives die head return to up position at twice down speed. Other features—automatic cycling with electrical interlocking . . . automatic power indexed table. Write concerning your productivity-problems.

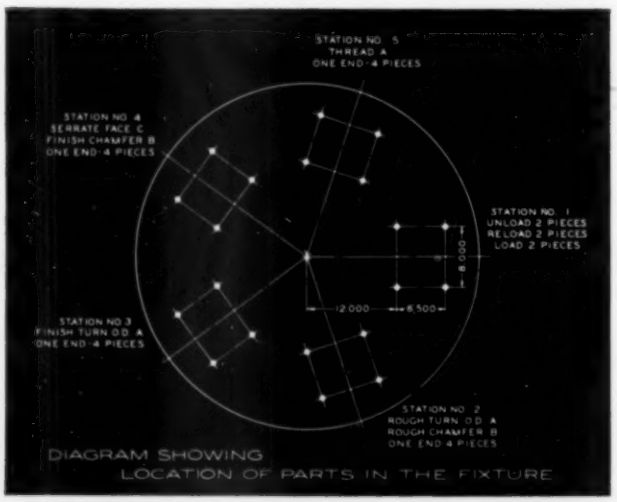
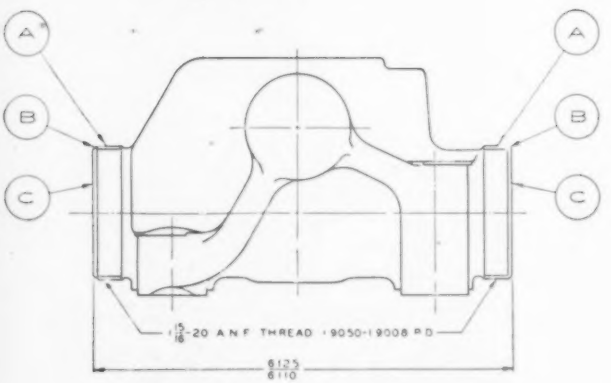


DIAGRAM SHOWING LOCATION OF PARTS IN THE FIXTURE



SHOCK ABSORBER BODY
MATERIAL—CAST IRON

BAKER BROTHERS, Inc., Toledo, Ohio

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To Precision Limits
(Both H.S. and Carbon Steel)

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Actual Size, Unretouched Photos of a few of the Taps Produced.

Get the INBUILT PRECISION so vitally necessary in the production of TAPS as REPRODUCING TOOLS for *YOUR* PRECISION PRODUCTION THREADING.

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SMALL DIAMETERS
LARGE DIAMETERS
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Demonstration at your convenience

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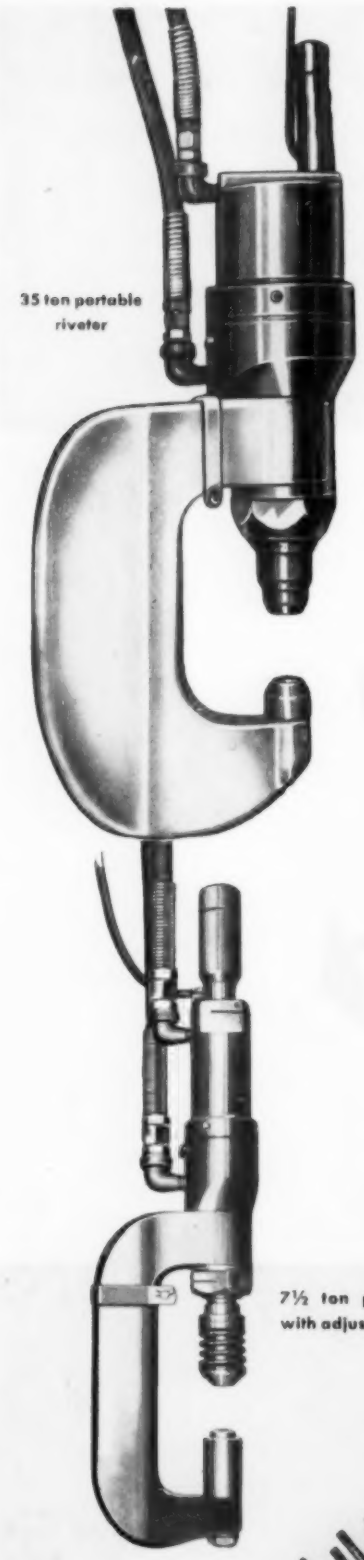
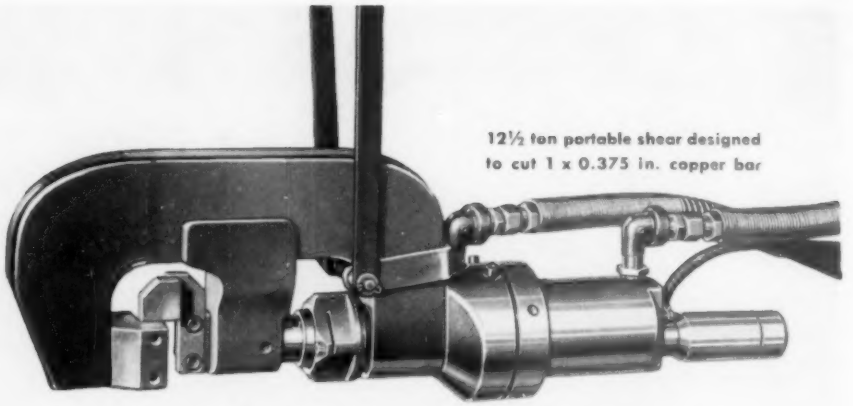


35 ton portable riveter



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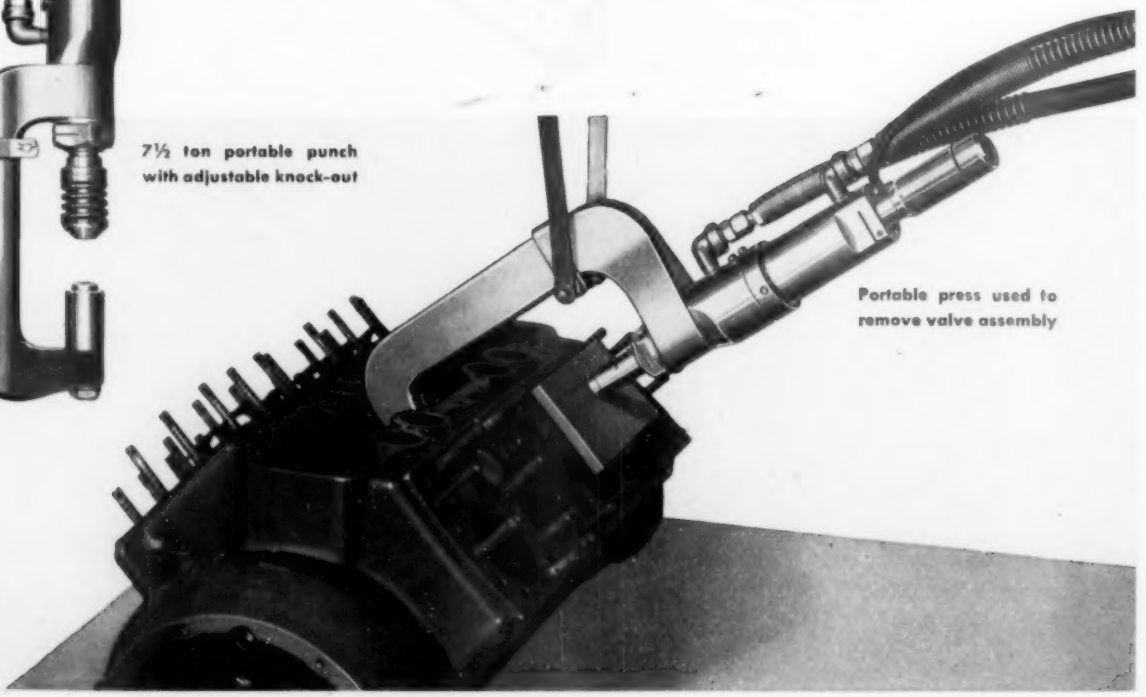
7½ ton portable punch with adjustable knock-out



Portable press used to remove valve assembly

SOMETHING MISSING?

TO COMPLETE THIS PICTURE OF PRECISION, ADD A

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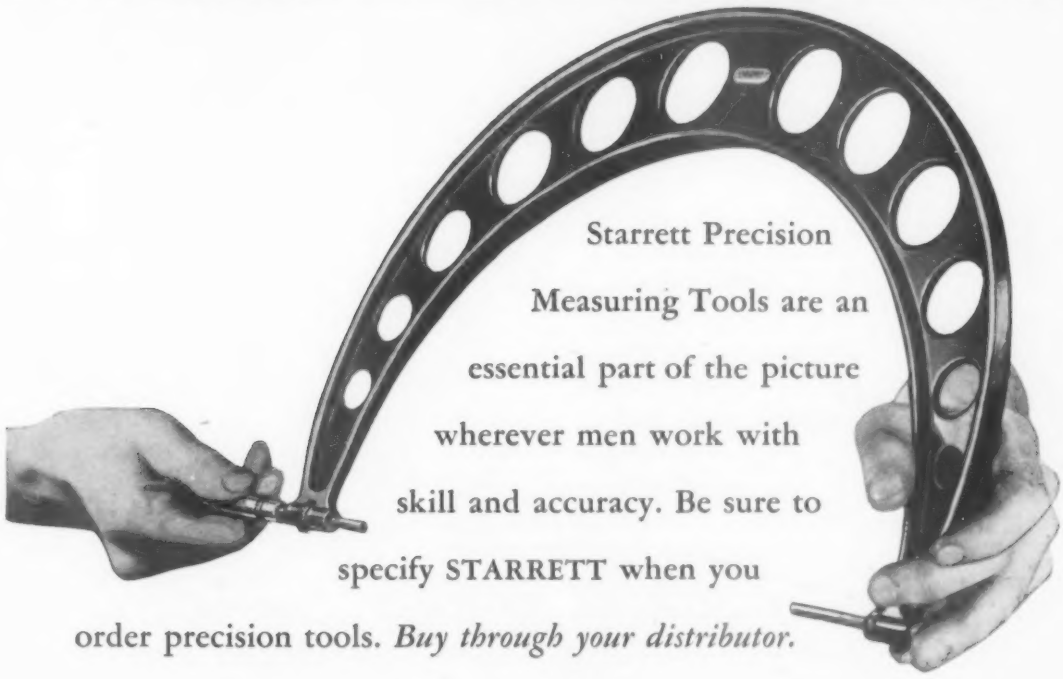

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STARRETT TOOLS

Announcing!

FOUR 1947 ADDITIONS TO THE SUPER LINE OF STANDARD CARBIDE TOOLS

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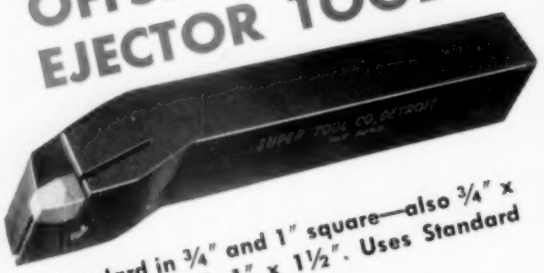
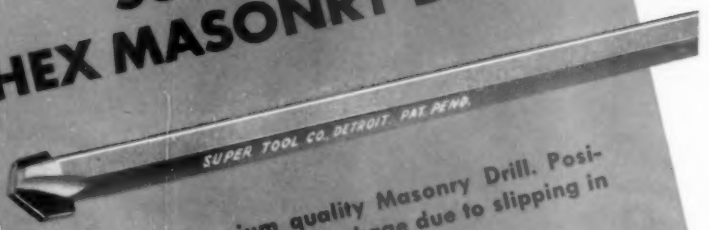


Standard in 3/4" and 1" square—also 3/4" x 1", 1" x 1 1/4", 1" x 1 1/2". Uses Standard Super Solid Carbide Inserts.

SUPER-GRIP HEX MASONRY DRILLS



A new premium quality Masonry Drill. Positive hex drive. No breakage due to slipping in loose or faulty chuck.

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For deep hole drilling. Stocked in 3/8" to 1 1/2" diameters, and in lengths from 12" to 20". Fast—clean—accurate—quiet in operation.

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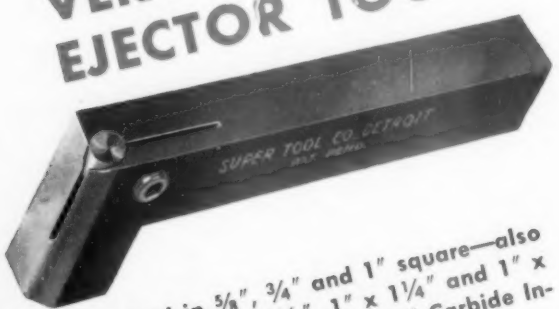

Standard in 5/8", 3/4" and 1" square—also 3/4" x 1", 3/4" x 1 1/4", 1" x 1 1/4" and 1" x 1 1/2". Uses Round Super Solid Carbide Inserts of suitable diameter.

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« Integration...the Way to Greater Achievements »

LOOKING AHEAD, time seems to stretch indefinitely. Looking back, as the current administrative year closes, time seems to have passed quickly.

The past year in A.S.T.E. history has been devoted to the furthering of the aims and objectives of the Society. Few innovations have been brought into being; but projects that were in progress have been developed almost to fruition, and the next few months will see their realization.

This administration has devoted the bulk of its energies to establishing a unification of action for the entire Society. Chapters, Members, the National Office, National and Chapter Committees, Officers, Board of Directors, and all other units within the Society, have all been working to reach well defined goals.

New accomplishments have again proved the time-honored slogan "United we stand, divided we fall." This is not a group of idle words. But we have not yet reached the ideal position in integrating our component units. We must realize, more than ever before, that to reach and maintain the position of leadership which has been set as the goal, our seventy-six chapters cannot operate as autonomous units. The 18,000 Tool Engineers represented by these Chapters must be cemented more strongly into the national organization, so that uniform and effective means will bring faster and better results.

Both internally and externally the American Society of Tool Engineers has grown in stature. This growth has been due basically to the coordination of the efforts of the Society's widespread membership engaged in the several branches of tool engineering . . . for, in the final analysis, these men *are* the Society.

One of our first duties is to stamp out forever the popular misconception that machinery or labor-saving tools reduce the number of jobs. No greater fallacy was ever given currency in a commonwealth of civilized and intelligent people. We must lead the way in teaching all of the people that each refinement opens a way to produce cheaply another product heretofore not justifiable economically.

We must support to the fullest the Society's program to provide educational facilities for more and better Tool Engineers. Conclusive studies have shown unquestionably that much of the training offered today has little practical value in streamlined industries, whose production methods have changed radically in the last decade.

Therefore, the American Society of Tool Engineers has taken the initiative to replace textbooks of the horse-and-buggy era with new ones to cope with modern tooling and production methods in American industry. Some of these completely rewritten textbooks are even now rolling off the presses to do their part in introducing modern tool engineering courses at educational centers.

A few months hence the TOOL ENGINEERS' HANDBOOK will be available to engineers, technicians, industry and schools throughout the English-speaking portion of the globe. This comprehensive technical reference work, indexed and cross-indexed, has been developed through a large expenditure of A.S.T.E. funds and thousands of hours of skilled effort by experienced and recognized contributors, to provide ready "know-how" for nearly every production problem. Awaited eagerly, this encyclopaedia of industrial technology will make available for the first time in concise form the correct answers for most production procedures in the metalworking field.

Cooperating with the American Standards Association, the Society has made great strides in standardization. One of the most impressive advancements in A.S.T.E. standards work has been the adoption and development of a system for classifying all industrial processes and every conceivable type of tool and piece of equipment that might be needed by Tool Engineers. Slated for immediate distribution, this index will be received as one of the most forward steps taken by an engineering or technical society in recent years.

The reputation of tool engineering has acquired an even greater lustre than during the war. The activities of the Society have strengthened its public relations position and have made industry, educational institutions, and the general public more aware of the importance of the exacting science of mass production.

In the national scene, these past months have been trying ones of transition. The change in production from a wartime to a peacetime economy has been accompanied with unprecedented trials and tribulations. Throughout this period, the Society and its individual members have contributed much to solving the complex problems involved and to bettering production.

Although for various reasons the country is still not out of the economic woods, the Society and its members are concentrating their individual and collective efforts on reaching quickly the production levels that will bring a favorable economic balance . . . economic security unfettered by professional planners and their wishful thinking. This means the application of mass production on the broadest scale possible to achieve the highest output for an ever increasing standard of living.

With this my final editorial, I leave the Presidency of the American Society of Tool Engineers, and turn my duties over to the capable hands that have contributed so much to the success of this Administration. To these sincere men, and to all of you who have helped in the Society's progress during my term of office, I extend my deep appreciation and heartfelt thanks.

Am Sargent

President 1946-47

By John C. Whitesell

Tooling for Fabricated Stainless Steel at The Budd Company*

Coordination of Engineering Functions Results in A Higher Productive Efficiency and Reduced Costs

RED LION PLANT of The Budd Company, located in Philadelphia, has over a million square feet of shop floor space and exclusively builds stainless steel railway cars and stainless steel truck trailer body assemblies.

The stainless steel used in our products is known as 18-8, and has a carbon content of approximately .10; and it is purchased in sheets and in coils, with thicknesses running from .012 to .2 inches. In the low tensile state the material has 90,000 pounds tensile, while medium tensile is 125,000 pounds and high tensile 150,000 pounds. Die formed pieces are mostly made of low tensile.

***John C. Whitesell*, author of this article, is Superintendent of Plant Engineering, E. G. Budd Company, and co-inventor of the Shotweld System of fabrication. He built the first Zephyr and the first stainless steel truck body. He also designed and built the first stainless steel airplane, which is now on view in front of the Franklin Institute, Philadelphia.**

Although stainless steel is used primarily and structurally in our railway cars, we do use other materials in the interior trim, such as aluminum and carbon steel. All of our stainless steel structures are fabricated by using the Shotweld System of resistance welding, producing welds of uniform strength by accurately controlling the current, the time that the current is applied and the electrode pressure. The system employs short periods of current flow to avoid the harmful carbides produced by long time welds.

The Welding Tool Group has an interesting problem of designing various tools for the welding of assemblies. Automatic welding machinery has been designed, and is available wherever the quantity of production warrants. Large subassemblies, which are jig controlled, are generally welded by having a portable welding tool suspended and balanced from an overhead structure.

The railway cars built by Budd can be classed as DeLuxe Hotels on wheels without sacrificing any of their services or comforts. In these cars, we have problems of building the main structure, along with all the other items—such as doors, windows, steps, insulation, air conditioning, heating, lighting, kitchens and dining car facilities—that go with it. Other items, such as curtains, carpets and berths, are also taken care of. The cars have a self contained electric system, and carry their own water supply. As these cars operate in climates from 40° below zero to 125° above, or more, it can be seen that all of these problems must surely intrigue the interest of Tool Engineers. We assume that they like knotty problems.

Stainless Steel Truck Trailers

The truck trailers made of stainless steel have been designed to carry a maximum pay load in a trailer of minimum weight. In this design, the sides of the trailer are the beams which carry the load. The trailers are welded into an integral unit, where each member takes its share of the load. The same principles of manufacture are followed in building truck trailers that are used in building the railway cars.

In The Budd Company, the work of the Tool Engineer starts when we answer the customer's inquiry and compile the estimate. Compiling the list of tools required in an estimate is of paramount importance. The Design Engineer and the Tool Engineer must be in accord. Often in their meetings, however, full details are not known.

In such cases, the Tool Engineer must use his experience and imagination and be sure that, if at all possible, the job will be designed so that it can be built on standard tools. Usually, however, a satisfactory solution will present itself if the Designing Engineer and the Tool Engineer work closely together.

The Tool Engineer should be ahead of design and bring out new methods that the Designing Engineer can incorporate in his design. In this regard, at your April, 1946, Cleveland Convention, the writer was pleased to see the accomplishments of the tool and machine engineering groups in presenting new methods of manufacture that can be incorporated into engineering design.

Coordination Is Essential

The Design Engineer should not create a design that the Tool Engineer does not consider practical to build. On a low production job the tool cost is more important than the finished piece price. Therefore, the Tool Engineer and the Design Engineer must work together, as it may be less expensive to make a piece in two parts, in smaller and cheaper tools.

The Tool Engineer who is working on processing cannot follow the old method of specifying "Shear, Blank, and Form." He must carry the job a lot farther nowadays and ask himself: "Why is it necessary? . . . What is its purpose? . . . Where should it be done? . . . When should it be done? . . . Who should do it? . . . How is the best way to do it?" There is one more *how* that should be added to this group of questions, and that is: "How many are to be made?"

It is not too difficult to process a job when only one unit is required to be made, and by the same token, it is not too difficult to process a job when 100,000 units are required. When one unit is required, practically speaking, you do not call for tooling. When 100,000 units are required one knows at a glance that full tooling is required as a job of this size cannot stand for hand work. But our problem, on some of our orders, is knowing how much tooling to call for when only a limited quantity is required.

The first question the Process Engineer should ask himself when the problem of making a limited quantity arises is: "Where are they to be made?" Then, he should survey that department and find out how much skilled and unskilled labor is in that department. Skilled labor can do a great deal with hand methods and requires less tools than unskilled labor. This should have a bearing on making the decision as to the amount of tooling required. *This is most important.*

*Adapted from a talk, by the author, at Philadelphia Chapter, A.S.T.E., November 21, 1946.

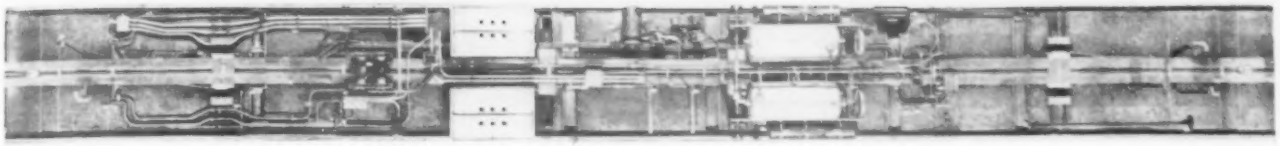


FIG. 1. Photograph of under-floor equipment mock-up.

In this modern way of working and manufacturing we become more dependent on each other. Team work and close cooperation is another *must item* between the Engineering, Processing, Tooling and Shop, as good tooling is not just a matter of every group taking care of its end of the job. Rather, it is a conception, or a main picture, that must be followed by all groups tying in with each other.

In The Budd Company, we build a railway car by making six major sub-assemblies, namely: floor, two sides, two car ends and a roof. In all of these units we do the maximum amount of work in sub-assembly. The floor is welded into an integral unit and inverted; we then locate and attach all of the equipment on the floor when it is in this position. The equipment, particularly the piping and the wiring, has previously been fitted to a mock-up before it reaches this operation, as shown in Fig. 1.

Beside installing the plumbing and wiring, we install air brake equipment, air conditioning unit, battery boxes, tanks, generator, coupler, and all items which will not be in the way of subsequent operations. With this method of working, the mechanics are working down on the assembly and not overhead as they would be doing if they had to apply the equipment to the car assembly. This assembly is approximately 10 feet wide, 3 feet thick, 87 feet long and weighs 32,000 pounds.

The railway car roof, another assembly 10 feet wide, approximately 4 feet high and 85 feet long, is assembled in a jig. It is then taken to a rain test station where it is checked for weather conditions. It is then removed from the rain test and inverted. In this position, it is sprayed with sound deadening. All piping, wiring, air ducts, air conditioning, and insulation is applied. The roof is then turned over, right side up, ready to be applied at final assembly.

At final assembly, the finished equipped floor is supported in the assembly jig to the proper car camber. Then, the two side structures and two end structures are added. The assembly is then welded together at the seams. The next operation is applying the roof, and welding it to the two sides and two ends, making a complete car structure containing as much car equipment as is practical to install at this time.

Rain and Weather Testing

The car structure is now placed on trucks, and is moved into an enclosure where the car body is rain tested. As it progresses down the finishing line to completion, it enters a hot room where all of the summer conditions of the desert are reproduced. In this room, the air conditioning equipment on the car is checked and adjusted for the comfort of the passenger.

To prove the strength of our railway cars, to our customers, The Budd Company has a 2,000,000 pound testing machine which tests a complete car structure. The test car, usually a skeleton structure and the first of a new design, is rolled in over tracks on the ground floor, then raised to a height of some 14 feet where the maximum load can be applied to the couplers. Other test loads are applied to the sides, top and bottom of the car during this test.

Sixty-eight Extensometers and some 500 electric strain gages, connected to a central panel are attached to all parts of the structure and surface during the test. This 2,000,000 pound testing machine not only checks the work of the Designing Engineer, but checks the product of the Tool Engineer as well.

Jigs

In our Tool Design Department, we have had to solve problems concerning the design of large jigs, some of which have an over-all size of 100 feet long, 20 feet wide, and 20 feet high. Wherever practical, when contours or shapes are required, we work from a template. This template can be used for the making of the part tooling, can also be used for setting the sub-assembly tools and, to check the assembly, can be used later.

As an aside, some readers may wonder why we call them "jigs" when they are fixed to the floor, but it so happened that we started to call them jigs and the name sticks. Some day, however, it is hoped that we will call a jig a portable tool and a fixture a fixed tool.

The normal width of the American railway car is about 10 feet. Our large assembly jigs are designed to be adjustable, and can build cars from 9 feet to 11 feet in width and up to 100 feet in length. When designing these large jigs, we attempt in all cases to have the workman stand on the floor, or on a platform or superstructure, where he can work at waist height.

We believe that jigs may be dispensed with if the parts are designed so that one can be satisfactorily located from another when the parts are being welded or otherwise assembled. If the parts are not too large, or too heavy, we prefer to carry the jig and the part to the welding machine rather than have the jig stationary and weld the unit by having an overhead portable outfit being brought to the jig.

The details of our drill jigs and machining tools are about the same as are found in other industries. So, we will only discuss the conditions we believe to be unusual in the aver-

FIG. 2. Drill at right, as ground for stainless steel.

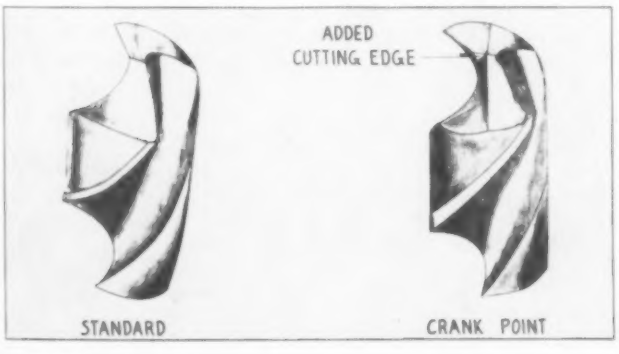
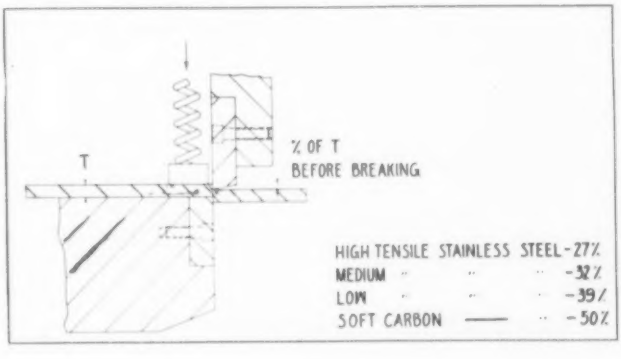


FIG. 3. Shearing stainless steel.



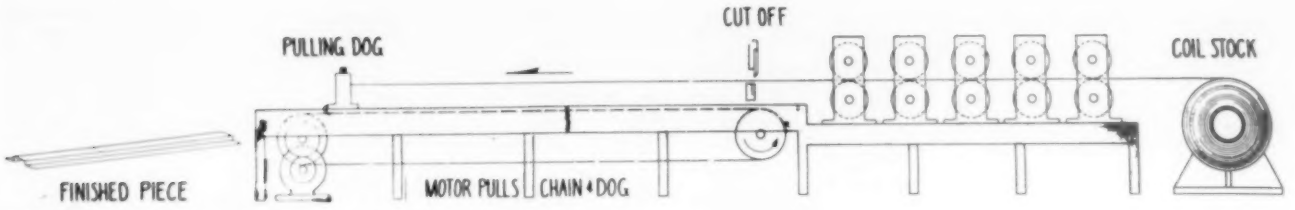


FIG. 4. The Budd type drawbench.

age run of work. Here again, however, this item of cooperation presents itself. When we decide to build a large jig in the Plant Layout Department, the Welding Department and the Tool Engineer each donate their talents to make the jig a success.

The Plant Layout Department is interested in the jig being set up for straight line production and located so that the expense of running services—such as air, electric and water—to the jig are kept at a minimum. The plant Layout Department is also interested in knowing how the materials are fed into the jig and where the parts or sub-assemblies are stored before the jig-operation, and what disposition is to be made of the finished assembly after leaving the jig.

The Welding Department will specify where the jig must be kept clear so their welding tools can be operated without interruption. The Tool Designer, in turn, must know what points to locate from and hold, so that the assembly will fit correctly in subsequent operations. So, it can be seen that the problems surrounding these large jigs are not just a one department responsibility.

We spoke, above, of materials going into the jig and the finished assembly leaving the jig, and that brings up materials handling. We cannot pass over that lightly. It is too important.

Materials Handling

When we speak of reduced manufacturing costs and better production methods, we are not only speaking of better tools and better equipment, but better ways of doing the work. The average young engineer may think that tools and equipment are the answer. But in modern manufacturing, Materials Handling is just as essential as the tools and equipment. In most plants, there is always sufficient thought allotted for the tools and equipment, and the Materials Handling problem is rated second.

The writer attended the A.S.T.E. Cleveland Convention, last April, primarily to hear the papers on Materials Handling. It was said there that, in some industries, the speed of some automatic machines had been increased to a point where the materials could not be brought to, nor the finished product taken away, at a rate that the machine could develop its maximum efficiency. Naturally, better conveyors are the answer, whether floor or elevated type.

Machining

The technique we follow, in the shop, for the machining of stainless steel is based on the following principles: During the early days of working and machining stainless steel, when no technical data was available, we learned that to obtain best results the cutter did not necessarily have to run at high speed.

Best results were obtained by having the feed set when the cutter approached the work, which permitted the cut to start immediately. Should the cutter have made a few revolutions, rubbing against the work without cutting, the results would have been unsatisfactory. The rubbing would have caused the metal to work harden on the edge to such an extent that it would have been difficult to start the cut. To machine stainless steel, the cutter must advance steadily in a rigid machine until the cut is complete.

Regarding what you may read about machining stainless steel, whether on a shaper, milling machine, drill press, or whatever the machining may be, it comes back to that one principle of having a good strong machine with a cutter working straight through the job without quivering or vibrating. That is the way that we obtain best results in machining stainless steel.

Drilling

The drilling of stainless steel was, at one time, a problem in our plant. Our recommended procedure of approaching the work with the drill revolving at a definite and steady pressure and speed, so that the cut starts immediately, is now standard practice. Then, by keeping the pressure constant on the drill until the drilling is completed, satisfactory results are produced. We now purchase standard high speed drills ground with a 140° included angle at the point. This is known as a crank point and is shown in Fig. 2. This drill presents less resistance at the point when drilling.

For drilling light gauge steel, where not too much heat is developed, no lubrication is required. When drilling heavier stainless steel we use a coolant which is either a mixture of water and water soluble oil, or a sulphurized base cutting oil. We recommend the cutting speed be based on 40 feet per minute.

Shearing

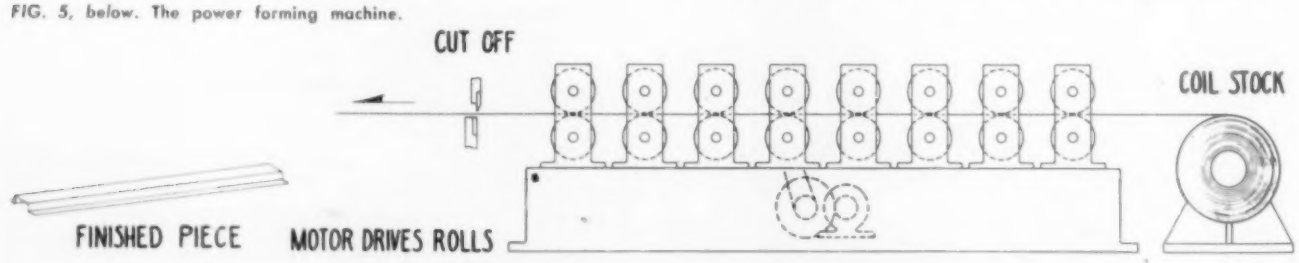
The shearing of stainless steel has been accomplished by using high carbon, high chrome shear blades in a machine of twice the capacity that is ordinarily used when shearing carbon steel. In this regard, the writer presents a paragraph from a booklet on the fabrication of stainless steel. In this book, they refer particularly to shearing of stainless steel.

This excerpt will show that some companies have different opinions of what takes place when shearing carbon steel vs. stainless steel. The article reads as follows:

> "The shearing of stainless steel differs from that of ordinary steel in that ordinary steel is cut only 25 to 75% of the way through and then breaks off. The stainless steel has to be cut all the way through, it does not break off."

In this regard, we conducted a test in the laboratory (as shown in Fig. 3), and found that the average carbon steel

FIG. 5, below. The power forming machine.



is sheared 39% through, medium tensile 32% and high tensile 27%. This information is diametrically opposite to what has been published, and it stands to reason that a hard material would snap off sooner than soft material.

When sawing thin gauge stainless steel with a bandsaw, at high speed, the teeth will wear at the edges. The saw then ceases to cut as a cold saw and, to all practical purposes, becomes a friction saw. We have noticed that, in many cases, the metal is red hot where it is in contact with the saw, which shows that the friction is rather high and we are working with a hot saw.

This condition was so obvious in the early days of working stainless steel that we reversed a wornout bandsaw and were able to saw with the back of the saw with nearly as good results as when we used it the correct way. However, it did require more time to get the cut started because one had to generate the heat.

Sawing Speeds

The bandsaws which we are using today are high speed bandsaws with a soft back. The saw is ½" in width, has 14 teeth to the inch and travels approximately 10,000 feet per minute. We also use an abrasive cutoff disc saw and a metal disc friction saw for sawing light gauge stainless steel sections. Both of these saws are approximately 16 inches in diameter and both can be run on the same machine.

The metal friction saw is made of semi-hard steel ⅛ inch thick and hardened on the edges. The peripheral speed is approximately 14,000 feet per minute. The metal friction saws are supplied having square teeth or regular saw teeth at a pitch of 3/16 of an inch. We have observed that the shape of the tooth makes little difference in its performance.

The decision as to which saw to use is dependent on the shape, size and thickness of the piece. The circular saw cuts in a straight line, whereas the metal bandsaw can cut to a pattern. However, long pieces are generally cut to length on the abrasive saw or on the metal friction saw. This is because it is easier to move the saw than it is to move the part.

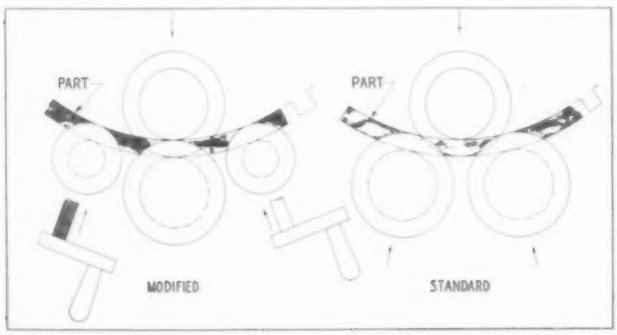
Shaping

The shaping of the flat stainless steel to structural shapes is done, in The Budd Company, by using the power brake, the Budd drawbench, or the power forming machine. When a new section is to be made we must analyze the merits of the three machines, and their characteristics, before we decide which machine will make this section.

Power Brake

The power brake is a Universal type machine that requires an operator to hold each piece against the gauges which locate the bend line during each operation. The results obtained are generally dependent on the operator's judgment. Should the stock have a natural camber when received at the brake you can generally expect to find the finished part to be cambered in the same direction. Therefore, one cannot expect the finished part to be consistently even on the outer edges.

FIG. 6. The 3-roll former method.



However, the brake is a much used piece of equipment and has a definite purpose. For short runs, where the lengths are not required to be made longer than the length of the brake, this is the method to use although the work is not as consistent, to size, as that which is produced by the drawbench or the power rolling machine.

The advantage of using the brake is that the material can be square sheared to correct lengths before brake forming. Therefore, time is saved in sawing and deburring, which is usually required when the piece is made on the drawbench or power rolling machine and then cut to length. The average accuracy of a 6-foot section, made on a brake, is within 1/16 inch.

Budd Drawbench

The Budd type drawbench (shown in Fig. 4) has been used by us since we began fabricating stainless steel. It is relatively simple to set up, has been successfully operated by men of little experience, and requires fewer rolls than a power machine. In this drawbench, which is ideal for average requirements, we generally have from four to eight sets of rolls.

These rolls float on the shaft as the material is pulled through by the chain, pulling a dog which travels on a beam producing a piece up to 100 feet long. The return of the dog is the lost time in its operation. In this method of rolling, the rolls do not have to fit tightly against the metal, which can, therefore, slip and accommodate itself to side strains as it is being drawn through the rolls while making the section.

Power Forming

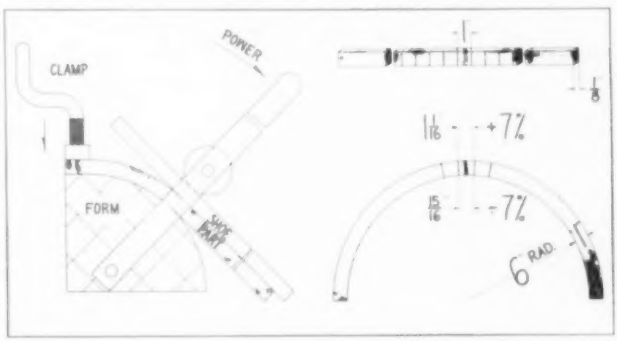
In the power forming machine, shown in Fig. 5, the rolls are power driven and the machine can produce a length of section, in one operation, as long as the coil or as long as the shop can handle. There is no dog, hence no lost time in the return, as in the case of the drawbench. The power forming machine is a real production machine—much faster than the Budd drawbench. However, it generally requires more sets of rolls than the drawbench, and a more skilled operator to set it up. But, this expense is warranted when large quantities of any one item are required.

The decision as to which machine to use is based on studies made whenever a new section is required. We must take into consideration how many feet of material will be required, of this one section, and how many feet will be made at one setting. Also the length of the piece and the tolerance required on the finished piece must be considered. Then, after surveying the tool cost and analyzing the figures, the decision becomes obvious.

Contouring

Contouring of the formed sections to the shape of carlines, as just described, (roof ribs and other sections as the rear end of the Observation Railway Cars) is done in the Budd Company by using one of three methods: The three roll former, the power bender or the stretcher press.

FIG. 7. The power bender machine.



Three Roll Former

The three roll former method (Fig. 6) is best adapted to forming sections of a consistent radius. It works to best advantage when the metal is quite thick in proportion to the height of the section, and when the section is of a symmetrical nature. The weakness in the method is the space between the rolls, which may cause the section to wrinkle, between the rolls, when under compression during forming. Forms are not required when using the three former methods.

Power Bender

The power bender method (Fig. 7) is also adaptable to forming a section to a radius. However, this machine has been designed in such a manner so that a radius which is not constant can be obtained. This operation is accomplished by having an inside form of the desired radius and shaped to fit the part. A shoe under pressure follows the section around while it is being formed.

The machine is also adaptable to forming several radii in one part providing the machine is equipped to make one bend at a time. One of the features of the power bender is that a part can be formed which has a varying cross section. However, spring back must be taken care of when these forms are made and tried out.

Stretcher Press

The stretcher press (shown in Fig. 8) is adaptable to stretching a part to a contour by gripping the metal on each end, and while the part is under tension it is wrapped around a developed form to the required shape. The metal is stretched to a point where it exceeds the yield strength by approximately 10 to 20%.

The amount of stretch is dependent on the thickness of the material and the yield strength of the material, plus the height and shape of the part. The amount of pull required is established at the time of tryout. The forms for both the power bender and the stretcher press are made from boiler plate or hard Masonite, depending on the part to be shaped.

The result of the action of forces on the material being shaped is different on the power bender than on the stretcher press. A test was conducted to show the action taking place. Two pieces of stainless steel $\frac{1}{8}$" x 1" were cut to size, and scribe lines, 1" apart, were placed on one side of each piece.

One piece was shaped to a 6" inside radius on the power bender, as shown in Fig. 7. The piece was removed and the spacing of the scribe lines was checked. The result was that the 1" line on the outer radius stretched to 1-1/16" or 7% very nearly. While the 1" line on the inner radius compressed to 15/16 or 7% very nearly.

The outer piece was also shaped to a 6" inside radius on the stretcher press (as shown in Fig. 8). When it was removed and the 1" lines were checked it was apparent that the outer radius stretched to 1-3/16 or 18%, while the 1" line on the inner radius also stretched to 1-1/128 or 1%.

From the above, it is reasonable to expect that the piece made on the stretcher press would have less spring back and would hug the form because the inner radius stretched 1% while the outer radius also stretched 18%, whereas on the power bender the inner radius compressed 7% while the outer radius stretched 7%. The stretcher press is now a much used piece of equipment in our plant.

Spinning

The spinning of stainless steel always presents the problem of how deeply it can be spun without requiring an annealing operation. Our company believes that if it has to be spun deeply enough to require annealing we are better off specifying that the part be made in a die.

Spinning, like all other hand forming, requires a skilled operator and the results are in keeping with his ability, but, a die set up on a press, and working correctly, will produce

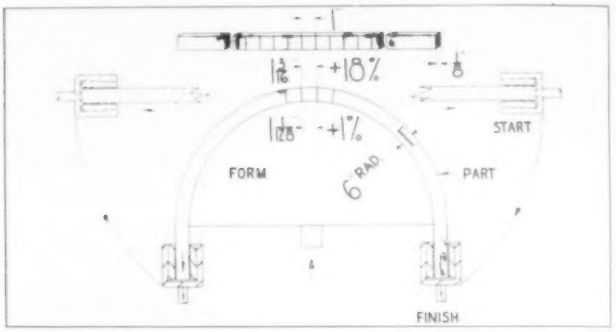


FIG. 8. The stretcher press method.

to better manufacturing advantage with a workman of lesser skill. However, we do spin parts when the quantities required are small. The forms are made of wood or steel, and are generally a low tool cost item.

Our mechanics are instructed to use a compound, generally brown soap (if available) and a brass spinning tool. Should steel tools be used, free iron may be deposited on the finished spun surface. If the part is to be subjected to the weather, it is recommended to remove the free iron from the surface by passivating the finished part in a bath of diluted nitric acid.

We do not believe that stainless steel is any harder to work on than other metals when the proper equipment is available in the shop. Grinding, polishing, soldering and miscellaneous shop operations are not difficult.

The design of our punches and dies are no different than those required for other materials. We do, however, select a fine piece of tool steel whenever a punch and die is required to be built, and select a good strong type of machinery which can work this strong metal without quivering.

The technique which our men have developed in the working of stainless steel is the only other item which is required to build these products, and the writer wishes that he had the ability to put other experiences, which some people call "know-how," into this paper. However, this paper covers the results of years of development in processing stainless steel, and we will continually be carrying on experiments in the future to improve the process. This work, you may be sure, will be done by the Tool Engineer.

Drill Chuck Selector

* A RATHER TIME CONSUMING chore, on the part of users, has been to select, from catalogs, the exact size of drill chuck required for any particular size of the various straight shank twist drills. Selection is now made easy, however, by means of a "slide rule" type selector offered by Scully-Jones & Company, 1915 South Rockwell St., Chicago 8, Ill.

The catalog number of the required chuck can be instantly determined by a simple setting of the selector—as, for example, the catalog number of a Style "B" Scully-Jones drill chuck. In addition, the selector recommends speeds and feeds for drilling various kinds of materials.

Thus, there is provided a great time-saver for engineers, draftsmen, tool room and production supervisors, as well as machine operators, not only in requisitioning the correct driver but in determining the speeds and feeds for efficient performance. The selectors may be obtained free by writing Scully-Jones Company on a company letterhead.

By Philip M. McKenna

Cemented Hard Carbide Compositions*

Revolutionary Material Has Effected Radical Changes in Metal Processing

HISTORY OF MAN includes, as one of its important phases, the development and use of tools and weapons, because man is primarily a tool making and tool using creature. Without tools, he is a comparatively helpless being; but with them, his control over environment is greater than that of all other creatures.

The historian has recognized the Stone Age, the Bronze Age, and the Iron Age, thereby classifying the state of development by the kind of tool materials used during each stage. Thus, the historian (usually not a technical engineer) has perforce given expression to the importance of tool materials in determining the state of culture of a society.

***P. M. McKenna*, President of Kennametal, Inc., Latrobe, Pa., is the fourth generation of a Pittsburgh family prominent in metalworking. As a boy of 16, he invented a process for separating nickel from cobalt, and was for several years associated with a company producing tungsten from low grade ore. Later, as Research Director and Vice President of Vanadium Alloys Steel Co., he developed practical applications in cemented hard compositions made from refractory compounds. His outstanding achievement was the synthesizing of tungsten-titanium carbide.**

This paper will deal with cemented hard carbide compositions, a distinctly new class of tool materials as compared to tool steels or other alloys made by melting processes; for these new tool materials are harder than the hardest tool steel. In a characteristic which is typical of each class of metals, namely Young's Modulus of Elasticity, it is noted that tool steel is 50 to 60 per cent stronger than bronze, while cemented carbide represents a much greater step in this direction: the Y.M.E. of cemented carbides being 100 to 200 per cent greater than that of steel.

Tools, appliances and machines are initiated by the human mind. When a fundamentally new material, as for the construction of tools and machine parts, becomes available to the engineer, designer and inventor, they too often think of the new material in terms of an older material with which they are more familiar, and they may think of it only as a substitute material in their new designs.

This lack of comprehension of the properties of a new material, and of the opportunities for the devising of better and often radically different tools and elements of construction of appliances and machines embodying the new material, often inhibits the prompt and early adoption of superior and fundamentally different designs. The economics of the article, tool, or appliance are so different in some instances that a re-analysis of cost and utility is sometimes required.

Accelerating Progress

In other instances, the change-over is relatively simple, and the economy so obvious that the introduction of the new material is feasible without much change in other parts of the process or in our thinking. It is in such cases that progress, in the application of cemented hard compositions, has chiefly been made during the first 15 years that this new material has been available. Single point tools, centers for lathes and grinders, drawing dies, precision gages and stops, wire guides, textile guides and other wear resistant articles were earlier introduced, using the new and very hard cemented carbide compositions, and to great advantage.

More recently, and with the aid of designers and shop men having greater appreciation of the opportunities and sufficient judgment and knowledge tempering their initiative and constructive abilities, there have been produced such products as cemented carbide milling cutters, reamers, routers, end mills, de-burring files, knurls, hot-flash cutting tools, seaming rolls, armor piercing projectile cores, chucking jaws and gripping devices.

Also, pump valves, and rolls for cold-rolling of steel, mining tools (namely, under-cutter bits for coal cutting machines) and rotary drills for drilling blasting holes. Today, we are exploring the applications in bearings, spindles requiring greater resistance to minute flexing, parts for gas turbines, and jet propulsion equipment, nozzles and orifices

*This paper was prepared for presentation at the cancelled A.S.T.E. Semi-Annual Meeting, originally scheduled for Pittsburgh, October, 1946.

Fig. 1, below.

PHYSICAL PROPERTIES

	Material	Specific Gravity GMS/cc	Conductivity: Thermal cal/sec/°C./cc	Conductivity: Electrical % of Copper Standard	Coeff. Thermal Expan. x10⁻⁶/°F up to 1200°F	Coeff. Thermal Expan. x10⁻⁶/°C up to 650°C	Magnetic Permeability μ Induction
KENNAMETAL	KM	12.00	113	4.7	4.0	7.2	3.0
	K3H	11.10	068	3.3	3.9	7.0	2.0
	K4H	12.55	127	5.3	3.7	6.7	2.0
	K5H	11.80					
	K2S	13.10			3.9	7.0	2.0
	K6	15.10	14	8 (est.)	2.5	4.5	1.5
	K12	14.05	15	8.9 (est.)	3.5	6.3	3.7
	KE5	14.20					
	KE7	14.70					
STEEL	HSS 18-4-1 Heat treated	8.6	061	3.0	7.0	12.6	
	1.10% C. Heat treated	7.8	14 (est.)		6.0	10.8	150-50
Co., Cr., W. Alloys		8.38 to 8.76	Low	1.8	8.0 to 9.4	14.5 to 16.9	Very Low
Brass 60-40 cold drawn		8.4	20		11.6	22.1	1.0

Fig. 2, at right.

MECHANICAL PROPERTIES

	Material	Hardness Test: Rockwell 60 kgs. A	Hardness Test: Rockwell 150 kgs. C	Hardness Test: Vickers 30 kgs. Load	Hardness Test: Knoop 2000 grs. Load	Transverse Rupture p. s. i. Calculated Beam	Young's Modulus of Elasticity p. s. i. Musical Pitch	Compressive* Strength p. s. i. Crush Tests	Torsion Strength Shearing Stress p. s. i. Min. Values Reported
KENNAMETAL	KM	91.0	77.6	1149	1300	305,000	74,000,000	650,000	125,000
	K3H	92.0	79.6	1238	1460	260,000	72,100,000	675,000	100,000
	K4H	92.2	80.6	1324	1500	225,000	79,600,000	680,000	
	K5H	93.1	82.2			225,000			
	K2S	91.5	79.0			305,000	80,100,000		
	K6	92.2	80.6			225,000	94,300,000	900,000+++	
	K12	89.0	74.0			350,000	77,000,000	600,000+++	186,000
	KE5	89.0	74.0						
	KE7	91.0	77.6						
STEEL	HSS 18-4-1 Heat treated	max. 85.0	max. 66.0	960			32,500,000	600,000	
	1.10% C. Heat treated	max. 83.0	max. 62.0	437			29,500,000		Est. 60,000 to 116,000
Co., Cr., W. Alloys		83.5 to 85.5	63 to 67			160,000			
Brass 60-40 cold drawn		56.7 B Scale					15,000,000	20,400	

for homegenization and colloid devices, and many other uses within the scope of production from cemented carbide.

An age old example of the inertia of the human mind occurred when bronze first became available over 4000 years ago for the making of axes, daggers, knives and spear heads. For some centuries thereafter these implements of bronze were merely copies of previous designs of these things when they were made of stone.

Progress Pathetically Slow

Man was slow to take advantage of the possibilities of making cutting tools and weapons of bronze. Tools made of flint were not so efficient as those made of bronze, because of the limitation in strength and the elastic limit of stone. Man seemed pathetically slow to realize that the properties of bronze permitted sharper cutting angles, as well as longer, thinner and more effective cutting tools and weapons. For a long while, bronze tools were merely cast in the mold made from the stone equivalent tool, which was used as a pattern.

Another instance of lag in the adoption of a superior material occurred in modern times—in 1740 to be exact—when Benjamin Huntsman, the Doncaster clock, lock and tool maker—finding that the bad quality of steel then available seriously hampered him—finally produced, after several years of trials, a satisfactory cast steel which was purer and harder than any steel then in use.

The Sheffield cutlery manufacturers, however, refused to buy it on the grounds that it was too hard, and for a long time Huntsman exported his entire output to France. The growing competition of imported French cutlery, made from Huntsman's cast steel, finally alarmed the Sheffield cutlers who, after vainly endeavoring to get the exportation of steel prohibited by the British government, were compelled to use it in self-defense.

Inertia in designing progress—especially in that type of progress made possible by a relatively sudden availability of a new material which has properties which are new and different and hence not readily understood—is still a human characteristic. This, despite the evolutionary factor of survival-value which accrues to the quicker witted. Perhaps the time lag in the adoption of designs made possible by new materials is less today because of the general use of concepts such as Young's Modulus of Elasticity and of such standard measurements of hardness as the Rockwell, Brinnell, and Vickers hardness tests; and also the Knoop hardness number.

Fig. 3, left.

To these may be added transverse rupture tests, torque tests, compressibility tests, abrasion tests, fatigue tests and other means of comparing materials, and of estimating in advance how they may be employed to best advantage. Properties capable of more specific definition, such as coefficient of thermal expansion, electrical conductivity, thermal conductivity, specific gravity, Curie point or magnetic transformation temperature are also useful and employed in observing cemented hard carbide compositions.

An actual use-test, however, is the best and only conclusive criterion; and fortunately, most tools, dies, wear parts, and elements of machines can be tested "in use" with relative practicability.

For a start towards compiling data to assist the designer in utilizing cemented hard carbide, let us refer to Fig. 1 and Fig. 2 which list properties of a series of cemented hard compositions.

Also, perhaps the showing of specific tools and appliances embodying cemented carbide compositions will be of practical use to the Tool Engineer. For metal-cutting tools, suffice it to say that different grades are required for cutting steel, than for cutting cast iron and nonferrous metals where the chip breaks very readily because of the low tensile strength and low elastic limit of the material being cut. For such work, the original tungsten carbide composition consisting of tungsten carbide with 3 to 10% cobalt is used.

Cratering Resistance Essential

For the machining of steel castings, forgings or bar stock either soft or heat treated up to 500 Brinell, stronger compositions resisting the "cratering" effect of steel chips, were required. Those containing the crystalline hard substance obtained by synthesis of tungsten, titanium and carbon in a molten bath of superheated nickel, and corresponding roughly to the composition W. T. C. (tungsten - titanium carbide) are required.

Such compositions, first introduced commercially in 1938, today account for the majority of steel cutting with carbide. Briefly, these tools for use in lathes, boring mills, automatic lathes and milling machines cut at speeds three to ten times as fast as tools of high speed steels, and last many times longer betweeen re-grinding operations.

Fig. 5, right.

Fig. 4, below.

Fig. 6, below.

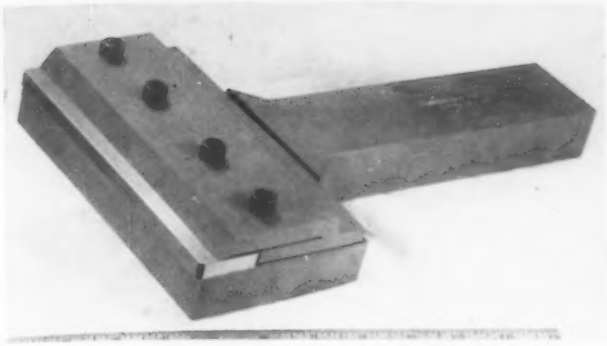


Fig. 7, above.

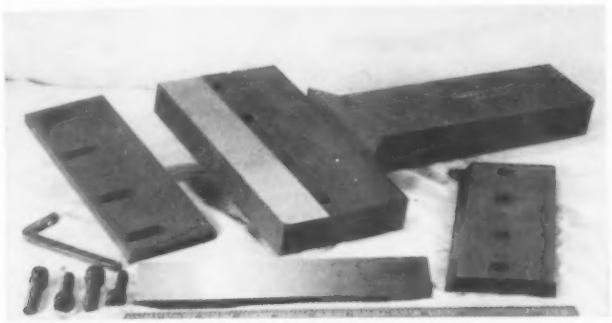


Fig. 8, below.

Such tools enable the manufacturer of machine parts to cut the steel work in the harder heat treated state, thus often dispensing with annealing before machining, and grinding after heat treating to the desired hardness. Thus, airplane parts are produced directly by the machining of steel forgings, heat-treated before machining with carbide tools, to give the highest physical properties.

Fig. 3 shows a familiar form of lathe tool used for machining steel projectiles. This tool is of the brazed type in which a tool tip of steel-cutting grade of cemented hard carbide is attached to a recess in a steel shank by brazing with silver solder. It has a chip breaker groove. Such tools enabled each man and machine to turn out three times as many projectiles per hour as would have been possible with tools of tungsten or molybdenum tool steel.

Tool Engineers, however, are all so familiar with the millions of carbide tools used during the past five years, and made by brazing the cemented carbide tip with a steel shank, that we shall not describe the many forms of these single point tools any further.

The difference in coefficients of thermal expansion of steel in the shanks and of the hard carbide tips, did cause some difficulty, due to straining of the tip material during cooling from brazing, and also when subjected to further thermal changes during work. Accordingly, for heavy-duty lathe tools, tips were attached by mechanical means, as revealed in Fig. 4, which shows a tool with a clamped-on tip.

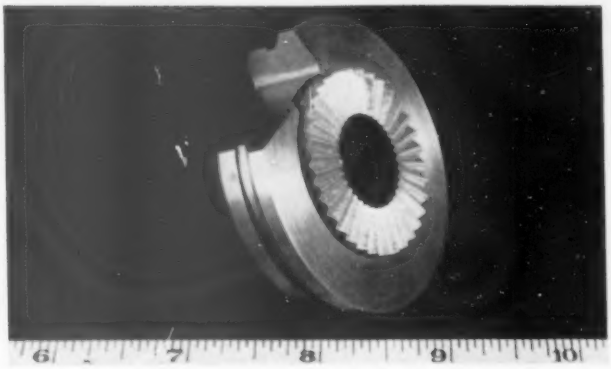


Fig. 10, above

By another method, the tip is attached through a countersunk hole, molded in the tip, through which a headless socket screw secures the tip, pushing it against the side walls of the recess. The tool shown in Fig. 5 is a roller turner tool with a screwed-on tip. This tool has been found to be much more durable under interrupted cutting—for instance, in cutting bolts from hexagonal bar stock—than the brazed tool.

Hard Shims for Heavy Cuts

For exceptionally heavy-duty work—as in the turning of 16" armor piercing projectiles taking roughing cuts up to 7/8" deep on a side and with heavy feeds up to .033"—a heavy-duty tool of this design is used, having a high speed steel shim laid under the tip for a seat.

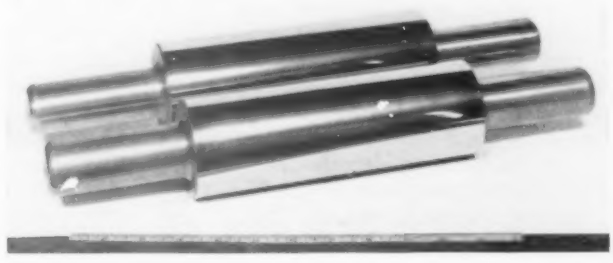
Fig. 6 shows some chips taken with heavy-duty steel cutting tools. Fig. 7 shows a carbide tool with clamped-in tip for turning chilled iron rolls, the tool being held on a "piano type" rest and fed directly into the work. Fig. 8 shows how it is clamped. Fig. 9 is a seaming roll employed in making of heavy cans; Fig. 10 is a solid circular form tool; and Fig. 11 is a pair of rolls of cemented carbide, used in rolling razor blade stock.

Fig. 12 shows an example of the better finish obtained by rolling metals with the harder rolls of cemented carbide: nickel strip at left in photo has been Kennametal rolled, and strip at right has been steel rolled. Fig. 13 is a typical set of carbide wire straightening rolls. Fig. 14 is a simple step cutter having blades tipped with a steel-cutting grade of carbide; and Fig. 15 shows the design of a face mill, having solid carbide composition blades, which has been found to be as much superior for milling steel, as the clamped-on tool has been for heavy-duty interrupted turning. Largely, it embodies the same idea.

We have not, in this paper, gone into the details of the remarkable improvements in milling which have followed the introduction of milling cutters having solid wedged-in blades of high strength cemented carbide. It is sufficient to

Fig. 9, left.

Fig. 11, below.



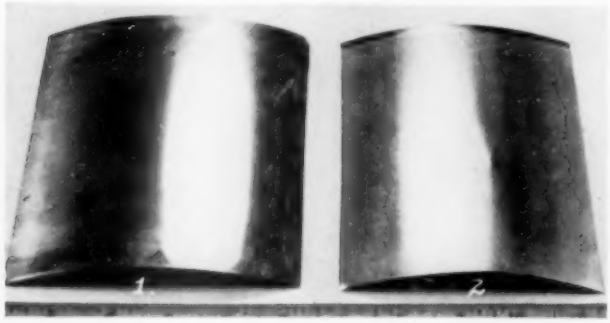


Fig. 12, above.

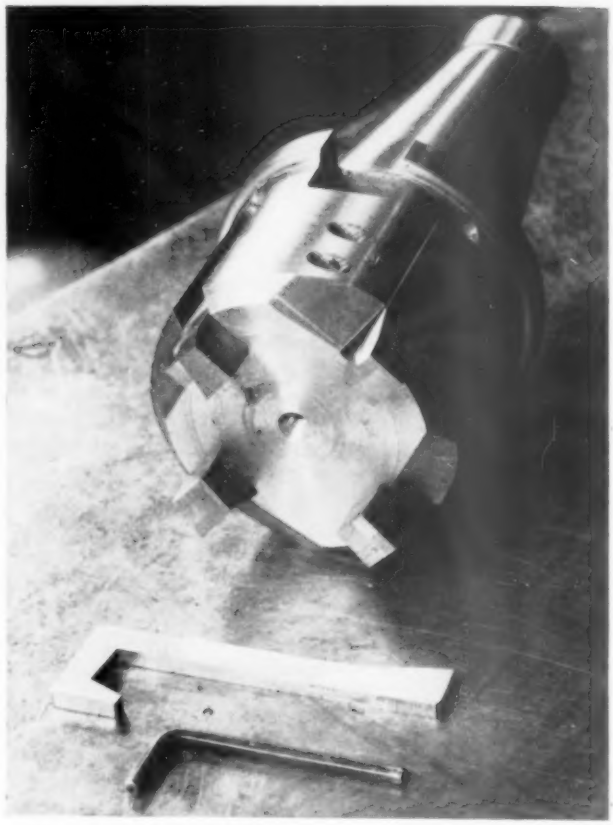


Fig. 14, at right.

say that the performance of lathes and boring mills has been greatly improved, that efficiency has been raised, and that the scope of work has been extended whenever these machines have been equipped with cemented carbide cutting tools. The milling machine is also being applied to greater advantage through the introduction of milling cutters which utilize the greater tool value of cemented carbide.

In general, the trend of design is toward the use of solid articles of cemented carbide throughout, or clamped-on blades for heavy-duty uses—as for metal-cutting tools, milling cutters, rolls, piston-grooving tools, routers, roll-turning tools and hundreds of other applications. Considering all this, it is hoped that this article—by historically reviewing and discussing advantages of cemented hard carbide compositions—has been of material help to designers and Tool Engineers.

A sequel to this article—"*Kennamilling*," by H. A. Frommelt will follow in the April issue, *The Tool Engineer*.

—The Editors

Fig. 13, below.

Fig. 15, at right.

Standardization of Diamond Tool Holders

Closer cooperation between machinery manufacturers and producers of diamond tools—in the standardization of diamond holders—is the aim of the Diamond Tools Committee of the Industrial Diamond Association of America, located at 501 Lexington Ave., New York, N. Y.

This standardization—in line with a movement initiated by the National Bureau of Standards, and also directly under the cognizance of the Division of Trade Standards in Washington—is expected to result in considerable savings to the users of diamond tools, both through smaller inventories and time saved.

Additionally, the Industrial Diamond Association has announced through its Executive Manager, A. D. Leveridge, that it has undertaken a survey of all its tool making members to determine abuses in the use of diamond tools, and that it will compile such data so that consumers of diamond tools may be advised directly of the best method of obtaining maximum utility and to prevent uneconomical destructive abuses. Results of the survey will be analyzed, one type of tool at a time, so that publication can be made in trade journals of advance chapters of the manual, as and when the information is cleared by the committees.

By T. D. Foy

Organization of Quality Control as a Management Tool*

Quality Can Only Be Improved Through Corrective Action Taken on the Basis of Accurate Analysis

DURING THE WAR YEARS the development of new designs, machines, methods and processes, to meet customer demand for better service and higher-quality products, was accelerated far beyond any previous advancement. These new developments, as well as the rise of standardization and interchangeability of parts requiring stricter tolerance conformance, have accelerated the development of the statistical method of controlling quality.

Thomas D. Foy **is a native of Pittsburgh; but he lived in Scotland, where he was educated at Airdrie Academy, until his 21st year. Returning to the United States, he entered the employ of General Electric Company, Schenectady works, in 1913. Having subsequently taken the business training course, he served successively for General Electric as accountant, works accountant, manager of the Bureau of Office Methods, and (the position he now holds) as Supervisor of Cost Reduction, Apparatus Mfg Division.**

Today, industry is more "tolerance conscious" than ever before. It has to be; and, as preparation is made to meet the demand for more and better products for more people at lower costs, there is increasing recognition of the need of some organized plan whereby a high level of quality can be established and maintained in manufactured products.

In the usual manufacturing concern, the use of quality control is begun on a small scale. A specific, particularly troublesome or costly project is selected, and the problem is analyzed, using control charts, distribution curves, or sampling tables. Corrective action, indicated by the data, is taken; and the results (improved quality, reduced losses and reduced costs) are tabulated and presented to management. With the approval of management, new projects for application are then determined, and the activity continues to expand and become more comprehensive as additional progress is made.

Quality Control Leads to Corrective Action

Gradually, however, it is recognized that the statistical method of controlling quality, though extremely useful in finding the cause of quality variations, is not a cure-all for manufacturing troubles. Quality is not improved, nor costs reduced, nor losses eliminated by mere statistical analysis of the problem, but rather *by the corrective action taken on the basis of this analysis*. Direction of such action requires cooperation and coordination, and it is on this premise that this article, "Organization of Quality Control as a Management Tool" is presented.

A logical decision as to the proper type of organization for quality control can hardly be made without sufficient understanding of the problems involved in controlling quality. So, for the purpose of this discussion, the following outline will be used: (1) What are the factors involved in controlling quality? (2) What is meant by quality control? (3) What is to be the purpose of the quality control organization? (4) What is to be the type of organization for quality control? and (5) Conclusions.

The Factors Involved in Controlling Quality

What affects quality? Where is it affected? How is it affected? Generally, *those items which affect quality* can be classified as: men; materials; processes; machines; specifications; and all others, including dust, humidity and extreme temperature.

More often than not, the reasons for quality variations cannot readily be allocated to just one of those items which has just been listed; usually, it is a combination of effects more difficult to evaluate individually. In a similar manner, *those functions where quality is affected* can be classified as: engineering; material ordering; planning and methods; manufacturing; inspection, and test.

Here again, a discussion of quality problems frequently involves more than one function of the organization before proper corrective action is obtained. When the possible combinations, of what affects quality, where it is affected, and how it is affected are fully analyzed, it is found that, for the most part, any one cause of quality variation might logically be the responsibility of any or all functions of the organization, dependent upon the type of quality problem involved.

For instance, a problem involving the quality of material for a particular application might properly concern:

(1) The engineer, from the viewpoint of original design and the selection of material tolerances.

(2) The material-ordering personnel, in the selection of vendors and the type of quality guarantee requested.

(3) The planning and methods men, in the selection of machines, tools, processes and the design of jigs and fixtures.

(4) The factory personnel, from the viewpoint of the skill of the operators, the machine setup and employee morale, among other factors.

(5) The inspection and test divisions, from the viewpoint of judging the quality of incoming material, processes and machine parts, sub-assemblies and the finished product.

To summarize, it can be seen that quality is affected by many different items, that several people exert varied influence upon quality; and that, to be fully effective, the organization must be so set up as to integrate the principles, and coordinate the effects of the quality control program in each section of a manufacturing division.

What Is Meant by Quality Control

In the past, quality control has been a source of considerable confusion, mainly because it has been interpreted in so many different ways. To some, it meant the usual over-all cooperative efforts of engineers, planners, factory supervisors and inspectors to maintain a given standard of quality in product. To others, it meant the protective endeavors of inspectors and test men to assure quality products to the customers; to others, again, it meant the organized examination of test and inspection data to be used as a basis for

*Resume of speech delivered before the American Institute of Electrical Engineers during their 1946 convention in Detroit.

corrective action. More recently, it has meant statistical analyses methods applied to engineering and manufacturing quality problems.

The attempt to clarify this new approach to the problem by use of the phrase "*Statistical* Quality Control" tends to imply that the application of these methods is restricted to special instances requiring the services of a statistical expert. In good practice such is not the case.

There are, of course—as already mentioned—many different approaches to this problem of controlling quality. Some of them have been in use for years; others, involving special techniques, are fairly new. A practical definition of this term, therefore, which includes the good points of both the old, and the new (statistical) concept of quality control is, "any organized management effort, statistical or otherwise, to establish and maintain required quality levels by suitable corrective and preventive action."

The Purpose of Organization

To control the quality of the final product obviously necessitates control through *all* stages of manufacture, from the conception of the engineering design through the final assembly. In the past, the factory has often been the recipient of, and unknowingly held responsible for accumulated errors in engineering design, material ordering, planning and methods—errors which remained undiscovered until actual manufacture of the product began. Through the use of statistical quality control principles in new designs, machine and process-accuracy studies, the sampling of incoming material and sub-assemblies, much of this can be eliminated. Industry is demonstrating the day-by-day effectiveness of the quality control program in controlling the quality of the product progressively.

The purpose of the quality control organization, then, is to: (1) Provide means of securing adequate data of current activity and progress, and establish the means of taking immediate corrective action at the source of trouble; and (2) to provide the means of educating all personnel affecting quality to the use of quality control principles so as to secure preventive action.

The Type of Organization

With the background of the foregoing comments, the type of organization required can now be presented. Consider first, locating the quality control activity in the inspection department. In justification of such a move, it might be pointed out that no one in the organization is called upon to make more decisions regarding quality than the inspector; therefore, he knows more about what should be controlled than anyone else.

Further, statistical sampling used almost exclusively by inspectors is a big part of the program to reduce manufacturing losses and inspection time. Again, it is the inspector who usually takes the data, and makes the report concerning the quality of the products, and he is thus in the best position to recommend what action is required to maintain quality.

Quality must be built into a product, however; it cannot be inspected into it. Therefore, it is not believed that locating the responsibility for the quality control program in the inspection department can be fully effective. Inspection is most assuredly a part of the program; without inspection data there is little idea as to what progress is being made, and where effort is to be concentrated. However, the program is much bigger than the inspection department itself.

The inspector is in the best position to classify the type of poor-quality characteristics involved—that is, such off-standard items as defective castings, holes drilled off-center, oversized and undersized shafts, burrs, poor finish and so on. This is important, but far more important is determining the cause of the defective work and initiating the corrective action necessary to prevent recurrence of the same error in the future. The inspector is not usually in a position to do this, primarily because it is not considered a part of his job.

An inspector, within the bounds of his present duties and responsibilities, can no more prevent the manufacture of poor-quality product than the fire department can prevent fires. If quality is to be controlled, the tools for controlling it must be put into the hands of the people who are exercising the most influence over it. In this way, the job is done correctly the *first* time rather than the *next* time.

Consider next the planning and methods section. Shouldn't this be a logical place to locate the activity? A planner most certainly influences the quality of the products in his selection of the processes, methods and tools. His position, where he can see both sides of the picture as the interpreter between engineers and factory supervisors, seems a likely place for the effective use of this method of controlling quality.

But here again, although planning and methods should be a part of the quality control program, this activity of controlling quality is much bigger than the planning department itself. The planning man's position would be somewhat similar to that of the inspector. He could take positive action on that part of the program of controlling quality which he directly influences, but for other parts of the program, such as new-design control, sampling inspection, machine control and assembly control, he could only recommend and suggest the action to be taken.

Similar arguments hold true, to a certain degree, in the case of engineering or manufacturing as possible locations for the sole responsibility of quality control activity.

Management Must Direct Quality Control

Another type of organization which meets the need for such an important activity can now be presented. There is frequent use of the expression "quality control is a management tool." If this is so—and generally it is agreed that it is—*direction of the quality control program logically becomes the sole responsibility of management.* Such a responsibility can be delegated, but can be effective only when it is fully understood by all concerned that the delegate represents management and, therefore, carries authority commensurate with his responsibility.

In a typical manufacturing division of the General Electric Company, for example, management is represented by an engineer responsible for the development and design of the product, and a superintendent responsible for the progress of the product after the design has been completed and released for production. Those persons who are to direct the quality control program must logically report to these representatives of management—as, for example, a quality control coordinator in charge of the activity, reporting to the superintendent, and a quality control engineer working with this coordinator reporting to the engineer in charge.

Duties of Quality Control Coordinator

With this arrangement, engineering activity under the direction of the quality control engineer, as well as material ordering, planning and methods, manufacturing, inspection and test activities under the direction of the quality control coordinator, can be organized to produce most effective results. In no way is this program to remove or replace the responsibility of the foreman of controlling the quality of the work under his direction, nor the planner and the engineer of their responsibility in their quality efforts. Instead, it provides them with a method of doing a better quality-controlled job through the use of distribution curves, control charts, sampling tables and their application to engineering and manufacturing quality problems.

In those cases where neither the causes of quality variation are readily apparent, nor the statistical approaches appear applicable, the quality control coordinator can properly initiate and organize cooperative effort to find the source of trouble.

Conclusions

The reasons for setting up the activity in this manner are as follows: (1) It has the direct backing of top management which is apparent to all personnel involved; (2) it locates authority with responsibility; (3) it provides for taking positive action rather than issuing negative warnings; (4) by proper coordination it avoids duplication of effort; (5) it avoids resolving the quality control program into a data-analysis program which presents the story but lacks the authority to do something about it; and, (6) it provides preventive as well as corrective action.

The large, modern factory organization of today is a highly complex, intricately functionalized mechanism with tremendous division of responsibility, each function making a special contribution to the ultimate goal of building a high-quality product at low cost which will provide service according to customer requirements. It is not the writer's intention to expound the virtues or faults of large industrial organizations other than to point out that, with such huge organizations, the problem of controlling quality becomes even more complicated because of the many diversified influences affecting it.

It is in contending with this problem that the quality control coordinator can make his greatest contribution. Not only is he concerned that the causes of quality variation be determined, but also that corrective action be taken immediately by persons responsible. The fault of some quality control organizations, which do not carry sufficient authority with responsibility, is that such corrective action is sometimes too long in coming.

As a representative of management, but removed from the influence of functionalized barriers, the quality control coordinator can best organize and propel the cooperative efforts of those sections most vitally concerned with the quality problem.

It may be valuable to again emphasize that the quality control activity must be organized to consider two approaches. The *first* is the short-range program involving the attack on specific projects in need of corrective action. Such an approach is productive of immediate results which can be evaluated in terms of quality improvement or cost reduction over some previously-established level.

However, this approach, although very necessary and effective, is more or less a temporary expediency designed to overcome undesirable quality variations in products under immediate consideration. Too much emphasis on the specific-project, corrective-action approach may sometimes obscure the more lasting benefits to be derived from the viewpoint of preventive action which requires greater organization and coordination to produce good results.

Long-Range Program Essential

The *second* approach is nonetheless important. If each of the functions previously mentioned—engineering, planning and methods—can influence the quality of a product, then each of these functions must be provided with the method of preventing undesirable variations in quality. This is the long-range program responsibility of the quality control coordinator and the quality control engineer—i.e., to so integrate the principles of quality control that they become tools of everyday usage for doing the job right the first time. To be successful, such a quality control program requires the support, organizational facilities and full cooperation of management.

By Fred M. Burt

Water Wash Spray Booth Operation*

Safeguarding Health by Precipitating Off-Spray Also Promotes Feeling of "Good Neighborliness"

Mr. Burt

APPLICATION OF COATINGS — such as enamels, lacquers, and paints—to a wide variety of metal and other products, is now almost universally a spray job in spray booths. This is particularly true for continuous or other types of large production runs. In nearly every such job, however, there is a considerable quantity of "off-spray" that does not deposit on the product and which must be carried away. It is essential, too, that this off-spray is not carried up an exhaust stack, to be disseminated in unsightly and harmful deposits on outer surfaces.

The fact that off-spray can be fully controlled and completely eliminated from the exhaust stream is fairly well known, but the design and operation techniques employed are not a matter of such common knowledge. This information is of considerable importance when choosing new equipment, or when improving existing units.

A type of water wash spray booth that, in operation, is unsurpassed for efficient performance has been developed on the West Coast—designed, built and installed by Acme Associates, Inc., Los Angeles, California. Therefore, to show in detail how pigment-laden air is exhausted from spray booths, through water wash systems, so that when the air emerges from the exhaust stacks it has all of the foreign particles "scrubbed" from it, an installation at Weber Showcase and Fixture Co., Los Angeles, will be used as the "case study."

The installation, as illustrated, was used for continuous spraying, of zinc chromate primer and Navy gray synthetic enamel, on life rafts and other heavy equipment. With some changes in arrangement to fit in with the present, peacetime production of consumer goods, it operates in the same way and with the same high efficiency.

On examining the inside of the 30" x 30" x 16' exhaust stream stack (see Fig. 1) after two years of continuously heavy operation with no cleaning whatsoever having taken place, the only deposits found to mar the clean surface were black tar spots from the installation of the flashing, and streaks from winter rains. If the exhaust stream had not been thoroughly cleaned, after two years—or even after a few days—there would have been heavy accumulation of deposits in the stack and on the roof around it.

*This article, on water wash spray, is an elaboration of the method, briefly touched on in a previous article, "Tools and Techniques for Truck-Trailer Production," by the same author in the February, 1947, issue of *The Tool Engineer*.

One of the stacks (all in identically clean condition) leading away from one of the 15 ft. x 8 ft. x 8½ ft. high spray booths on the overhead, chain-conveyor spray line is shown in Fig. 2. At each end are 4 ft. x 4 ft. vestibules with swinging door for work in transit and to act as escape doors, as shown in Fig. 3.

In the wall opposite the water wash section there are twenty-four 20" x 20" Air-maze Type K2, Kleenflo cleanable filters. These are individually removable, and the interlocked wire mesh filters carry a film of special, viscous oil to trap the dust. When loaded with an accumulation of dust, the filters are then removed, immersed in cleaner, and re-sprayed with oil. There are four 500-watt incandescent electric lights above, located behind 22" x 24" close mesh wire glass windows and backed up by vapor-proof, dome-type, porcelain enameled reflectors.

The exhaust stream is drawn across the working area, at 150 ft. per minute face velocity, by three 21" blowers having a total air capacity of 22,800 cfm. These are mounted on a common 1-3/16" line shaft, driven by a 10-hp constant speed motor at 1800 rpm. A static pressure of 1¼" (water column) is provided and maintained.

The water is re-circulated from the collecting tank through the spray manifolds and nozzles by a pump of 360 gpm capacity, driven by a 7½ hp, 1800 rpm motor. (See Fig. 4.) In the makeup tank, which is connected to the outside water supply, a float valve maintains a constant level in the collecting tank. When the water level drops, the float drops, after the manner of a float in a toilet tank, and opens the valve for admission of water to the proper height. The water that enters the makeup box, to maintain the like level, comes from the bottom of the collecting tank, thus preventing any but clean water from entering the box as might be the case were the orifice at water level.

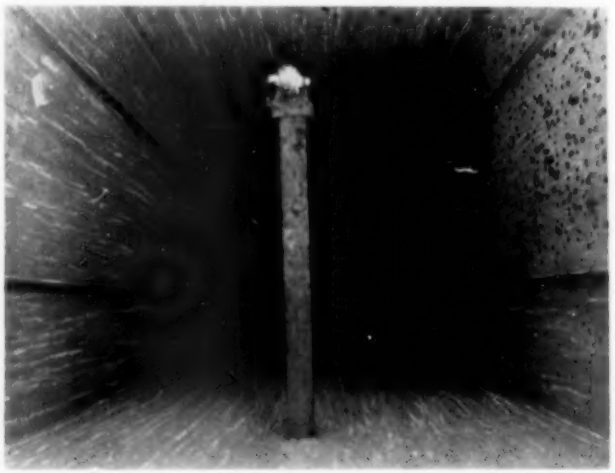


FIG. 1. View looking down into spray booth exhaust stream stack, (Weber Showcase and Fixture Co.) with 21-in. Acme blower shown at bottom. Spray head on fire protection system at top is entirely unnecessary even though required through a technicality.

FIG. 2. One of three identical spray booths on continuous line at Weber Showcase & Fixture Company.

At 150 fpm average face velocity, the air moves across the booth at a rate that changes the total air volume every three seconds—the length of time of travel across the 8 ft. working depth. When the pigment-laden air is drawn out of the booth and up behind the inward sloping metal shield, it meets a downward spray from the nozzles, spaced nine inches apart in the horizontal manifold.

Similar to Churning Butter

This nearly head-on collision, between the vigorous water spray and the upwards-moving pigment particles, starts churning and battering the particles and causes many of them to combine into larger particles. The larger the particles carried into the exhaust air stream, the greater the tendency to precipitate into the collecting tank.

As the air and particles of pigment pass on, over the water curtain shield and start downward, they are followed in "rear attack" by spray jets from another set of nozzles in the same manifold at about 25 lbs. pressure at the nozzles. The particles are again hit and driven together, by water impact, at an acute angle of incidence to the general direction of air flow. Here, the churning and battering is further heightened as the air and particles run nearly head-on into an upwards spray from similar nozzles in another manifold.

In further downward travel, the heavier particles drop into the collecting tank, thus ridding the exhaust stream of the major percentage of pigment particles. The rest are carried, at the increased velocity (which is accelerated the closer the air stream approaches the blowers) through the double, vertical eliminators. See Fig. 5. The distance from side to side is 8½", but the travel distance is much longer as there are six turns or bends in the sinuous and tortuous progress of the air, travelling as it does at about 600 fpm.

Hitting one side of the eliminator—and then bouncing around a curve, of some 90 degrees, to the opposite side—most of the particles in the moist air are driven by centrifugal force against the eliminator sides, along with the moisture also carried. The particles tend to cling to the metal sides of the eliminator and are washed downwards by the cascade of water on the entering sides of the eliminators, to be precipitated into the collecting tank.

FIG. 3. Inside view of spray booth shown in Fig. 2. Note cleanable filters at left, water wash system at right.

By the time the air leaves the exit sides of the eliminators, the last of the pigment particles, and virtually all of the moisture have been "rubbed" out of the onrushing air, which is then drawn up through the blower and out the exhaust stacks — completely washed and scrubbed clean of particles and even rid of all excess moisture.

An innovation, which prevents foaming liquid in the collecting tank from bubbling over its front wall into the spray booth, is provided by a steel trough (see Figs. 6 and 7) along this tank front. Four inches down from the upper edge, and three inches wide, this trough ranges from two inches to eight inches deep to provide a good slope to carry away, to a sewer outlet, the liquid that results from the breaking down of the bubbles in the foam that is arrested by the trough in its tendency to overflow the tank.

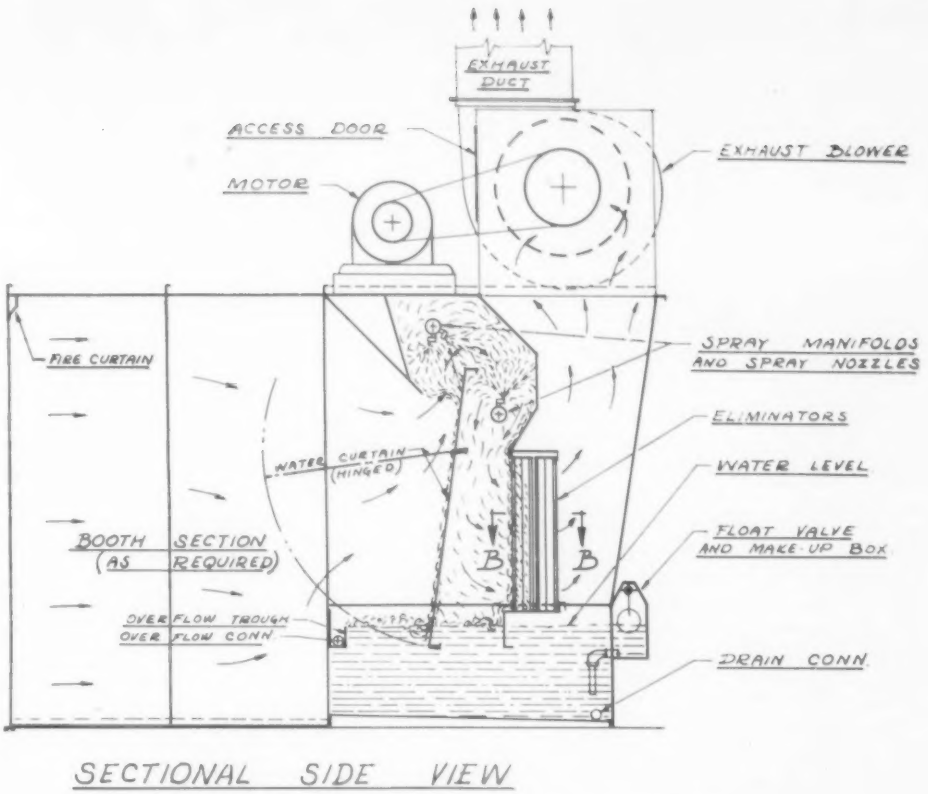


FIG. 4. Sectional side view of the Acme Water Wash Unit.

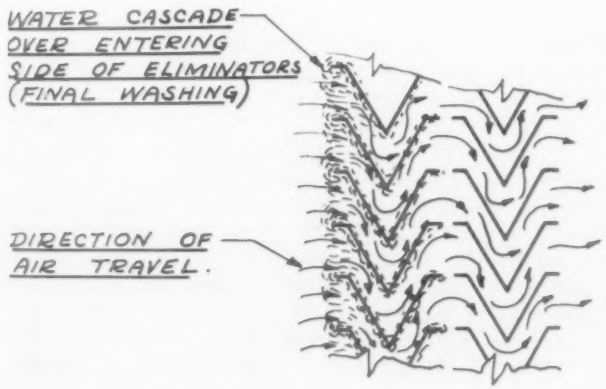
Deflocculator Chemical Added

This foaming action is heightened by adding a deflocculator chemical to the water in the collecting tank. Using the popular Turco Deflocculator, as a typical example, its purpose, nature and action are as follows:

The deflocculator is added to the circulating water with an initial charge of 1/3 oz. per gallon, with further additions of 1/6 oz. per gallon every four hours of operating time. It is a dry, dustless, non-segregating granular chemical product composed of powerful ingredients, of pleasing odor and calculated to dissolve immediately and completely in cold water. So that every particle of the deflocculator may be used, it must have a high buffer index and high colloidal activity to work fast and efficiently, with no semi-active or inert ingredients.

When the particles of paint, enamel or lacquer are washed out of the air and precipitated into the deflocculator solution in the collecting tank, the oil and resinous vehicles are readily wet out and emulsified, and the pigments thoroughly dispersed. In other words, the flocculent masses (aggregate or compound of particles) are separated into non-flocculated masses or particles and reduced to what may be termed a molecular state of subdivision. Thus, they cannot deposit on the metal walls and the cleanliness of all parts of the water system is maintained.

FIG. 5. Section BB, of Fig. 4, through eliminators.



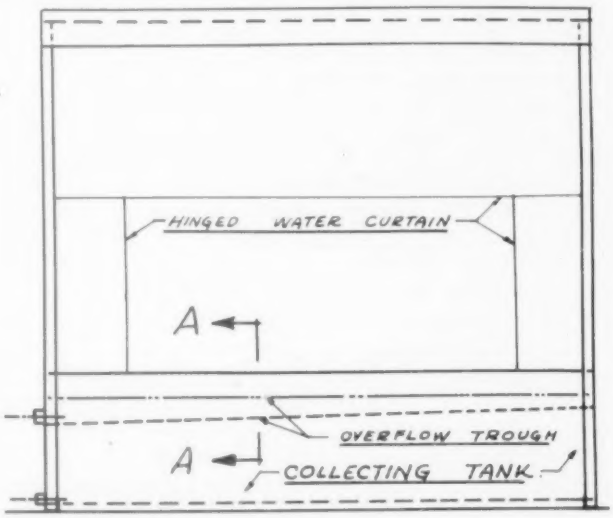
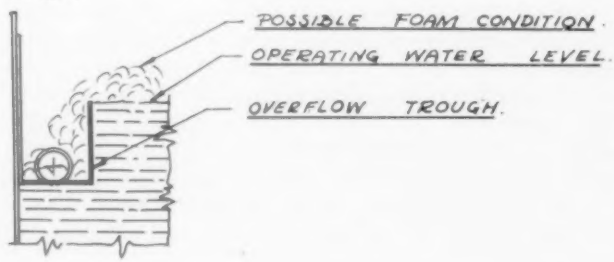


FIG. 6. Front view of the Acme Water Wash Spray Unit.

FIG. 7. Section AA, Fig. 6, through trough. This trough prevents foam overflow.



By A. M. Sargent

Production Unlimited

Mass Production, with Its Low Unit Costs, Has Raised Living Standards of American Workers to Record High

Mr. Sargent

TODAY MOST OF US are very unhappy because our economy is disturbed by inflation. Prices are skyrocketing and certain elements of organized labor and of management are pursuing the short-sighted policy of demanding more wages and more profits than present industrial production warrants. Goods are scarce and money is plentiful. There are $225 billions of cash spending power stored up from the war period, not to mention the billions in bank and consumer credit. But war production, which realized this tremendous purchasing power, was expendable and consumers' goods are not yet available in sufficient quantity to turn the "sellers" market into a "buyers" market. The obvious answer is that industries must produce now and fast . . . and continue to produce.

The question before the nation is how may we increase our production and what may we expect of it. No sincere person will represent himself as having the answers to all of our economic ills or an infallible plan that will lead us to the Promised Land. Some principles, however, are basic and should be incorporated into the thinking of every American who would preserve our way of life.

Until that time, when our industry has picked up the slack and is fully engaged in peacetime mass production, it behooves each of us to act with restraint and measured judgment. Production, in itself, cannot immediately avert the dangers of inflation. A democratic economy gives each of us the right of individual enterprise, but not to the detriment of our fellows and the economy as a whole. With this right go certain responsibilities. An economic jungle can lead only to chaos. For the immediate problems, there is a need for coordinated effort and intelligent policies. This calls for real understanding between government, labor, and management. Mere laws and bureaucratic dictates only postpone the inevitable and are no stronger than the wishes of every American, regardless of his place in our economy.

Let us not indulge in any wishful thinking. Everyone is talking about increased production. Many are uttering mystical, fervent statements of the great blessings to befall us from unlimited production. But like Heaven, everyone talking about it isn't going there. Out of date production methods and fuzzy, emotional thinking will not yield an indefinitely expanding production.

If our economy is not to falter in its stride and is to continue forward, basically we must reaffirm our faith in mass production and the future it holds in store for us. When we compare the standard of living of the average American to that of the average citizen of any other nation, the widespread benefits of our system are obvious. When we compare the wages of an American worker to the wages of a European worker doing the same job, it is obvious that the American worker receives a much greater share of the benefits of production. This did not come about by chance and is a direct result of our system of mass production, which is known in Europe as the "American System."

The source of our wealth and well-being lies in the greater productivity per worker per hour than in any other country. Before the war, an American coal miner was able to produce twice that of a German miner and two and one-half that of a British miner. American blast furnace production per worker was three and one-half times that of Britain, steel products production four times as much, radio manufacture five times as much. These facts are given not to make comparisons between our workers and the workers of other countries. The latter are just as sincere and skilled workmen as our own. The source of the greater productivity of the American worker lies in more and better machine tools, machinery, and tool engineering. That day is gone in America when production was increased by putting pressure on the hired help. Further, our available manpower supply has almost reached its maximum. Now that we are in need of even greater production than we have ever known before, the answer lies in still better machine tools, better tool engineering, and further mechanization. But this mechanization and tooling must be accomplished for industry as a whole and not piecemeal as in the past.

Certain industries in this country are so insufficiently mechanized that the resultant higher cost per unit of production serves as a penalty to those engaged in more efficiently mechanized industries. Agriculture as an industry, despite the heroic efforts of agricultural implement manufacturers, lags far behind the metal working industries. Some individuals in the building industry, under the extreme pressure of a housing crisis, are turning to prefabricated or machine produced houses; however, they are being resisted by others who would penalize the country in their monopoly of the skills required for custom built homes. There is a mass demand for houses; this calls for mass production. There is virtually no end of the ramifications of mass production and tool engineering in every phase of life.

Two Myths Exploded

Before analyzing the role of machine tools and tool engineering in an ever increasing production, let us eliminate two myths. One is that there can be any danger from "overproduction." The other myth is that a worker's wages can be raised arbitrarily without any relationship to production.

There has been much talk about the great American production potential and the fear that it may produce us into an oversupply of consumers' goods and thence into another depression. Actually, no depression was ever brought about or can be brought about by overproduction. The problem in our economy which remains yet untouched is proper distribution, the solution of which rests with each of our industries providing comparative production and real wages. Each of us needs enough, the domestic and world market demand enough, that the problem resolves itself into underconsumption. This is no idle play on words. When that time comes when each and every one of us has all that he needs or wants, all that he can use, all that he can earn, at that time we can think in terms of overproduction. But so long

Reprinted from article, "It's Like Heaven," in November '46 *Surplus Record*. Subheads have been added.

as life goes on, so long as discoveries and inventions broaden our horizon, this is not even a remote possibility. We have only to produce; the need is there and pressingly so.

The other misconception is the source of real wages. To have mass production and a market for the goods produced, it is necessary to have mass purchasing power. In America this is met by a fair distribution of the results of production. A recent study of the proportion of their total receipts paid out in wages by American manufacturers over the last ninety years revealed that proportionally to the goods produced wages have not changed more than 10 per cent one way or another. During that period real wealth and wages went up. In other words, wages are dependent on the dollars worth of income production per hour. To increase wages on the broadest base it is necessary to increase the productivity of each hour's work.

It has been pointed out that this responsibility rests on an intelligent use of machinery and tool engineering. Continued prosperity depends on the proper balance between a man's productivity and the amount of return he gets for an hour's work. The worker in a highly mechanized industry can produce enough wealth to enable him to get a high return for his labor and at the same time keep the commodity prices down. Workers in the lagging, non-mechanical industries cannot do this and therefore tend to throw the economy out of kilter.

This is not to say that the non-mechanical industries are necessarily the lowest wage paying industries. Often it happens that an arbitrary high wage, all out of proportion to the actual wealth produced, must be paid either to attract workers or to satisfy an artificially induced shortage of skilled workmen. This is of necessity passed on by the manufacturer to the consumer in uneconomic increased costs. It is this needed balance between production costs and wages which can be realized through proper mass production.

What, then, is the true essence and application of mass production?

Skill Built into Machines

Mass production is the ultimate utilization of machines or devices capable of assuming the tasks of accurately guiding the cutting or forming tool, holding the work, assembling components and joining metals, as well as the loading and unloading of material and finished parts, requiring less effort and skill of the worker, a variable factor at best. This is based on the principle of transference by which production brains are able to put into a machine the necessary skills, making the quantity and the quality of the work dependent on the machine and not upon the machine operator.

Mass production does not imply huge operating setups, but rather specialization. For one man to build a house is more time consuming and inefficient than for a crew of men, each specializing in a particular detail. Carried into manufacturing, the more specialized the operation of a machine, the more it can assume the transference of skill to itself.

The economic benefits of mass production are reduced cost of unit production, compensation for the cost of the machine or the tooling as more items are produced, higher profits based on real wealth produced, and similarly higher wages based on more production per hour.

Considering the staggering impact on the civilization of the world, it is even more remarkable when one recalls that mass production, or to give it the engineering term—"interchangeable manufacturing" is of comparatively recent origin, and it is as difficult for the American public to accept as any other modern invention or development. It did not spring into existence suddenly and abruptly but was the result of the accumulation of ideas and machine tools which we associate with the beginnings of the Industrial Revolution.

The Industrial Revolution

The Industrial Revolution, however, came to fruition in the hands of Tool Engineers and machine tool builders. Watt's steam engine was an expensive novelty until 1774, when another Englishman, John Wilkinson, devised a guided boring bar and a work-holding device to bore the cast iron cylinders, the first horizontal boring machine. But more than that, for the first time, there was provided an accurate means of holding and guiding the tool in a metal cutting machine.

The lathe is an ancient machine tool, dating back to the days of Egypt, but it was not until between 1797 and 1810 that an Englishman, Henry Maudslay, perfected the slide-rest which permitted a mechanically guided cutting tool to cut accurately and made possible the screw cutting lathe. That the engine lathe is the ancestor of most machine tools is a truism.

The planer as we know it to produce accurate plane surfaces, replacing tedious and lengthy hand chipping and scraping, subject to human error, was first conceived by Sir Samuel Bentham in 1754, but became a practical reality in 1817 in the work of an Englishman, Richard Roberts. His was not the first planer but it is definitely the ancestor of the modern planer. Roberts' machine is still in working condition in a museum. Thus all machine tools could be more cheaply and quickly provided with accurate ways and guide slides. The stage had been set for mass production.

Although first attempted successfully on a small scale in France in 1785 by LeBlanc in the manufacturing of muskets, it remained for an American to bring mass production to practicality and to establish it as distinctively American.

Our first Tool Engineer was Eli Whitney, better known as the inventor of the cotton gin. In 1798 he received a contract from the United States for the interchangeable manufacture of muskets. Starting this phenomenon in manufacture,

almost from scratch, he devised many machine tools or improved existing ones. Even more significant as an original contribution, he devised techniques of making jigs, fixtures, and gages and trained his workmen in his new system of limits and tolerances. Whitney's methods were firmly established in the United States by 1815 and by the end of the Civil War, for the first time, what could then be called a "flood of goods" was pouring forth.

The interchangeable system of manufacturing spread to clocks, sewing machines, agricultural machinery, and provided the means to give communications equipment, textile machinery, transportation equipment, domestic appliances, and business equipment to the masses of America who thus earned the means to buy the products of their collective specialized efforts. This is the essence and origin of mass production. What then is its best application?

Operator Effort Reduced

From the brief review of the origin of mass production, it is obvious that the application of production machinery revolves around as complete a mechanization of operations as is possible. These operations are either inherently within the machine or are achieved through the application of jigs, fixtures, and special tools to take up where the machine leaves off, thus ever minimizing the effort of the machine operator.

In practice a choice must be made between three types of production machinery: For small volume, standard machine tools; for a tremendous production, completely special productive machinery; for a compromise, i.e., an extended production but subject to style and design changes, standard basic machine tools equipped with highly specialized fixtures, cutting tools, and jigs which can be readily altered or discarded as the need arises.

The fact that a recent survey revealed that the bulk of the machine tools in use today are 10 years old or older makes one realize the tremendous field that lies ahead. The 1941 production methods which bore the brunt of our war production are already outmoded. No matter how excellently designed are the tools, jigs, or fixtures employed in conjunction with a machine, they are limited by the intrinsic accuracy and nature of the machine itself. This makes the newly built and the rebuilt war production machines of greater importance today. And it makes the design of new and better machines mandatory. That the tremendous strides and discoveries of increasing production brought on by the necessity of the war have not yet filtered through to all industries, is, alas, only too true.

With due respect to the tremendous work of Gilbreth, it is now a case of applying the best way of utilizing a machine and continuously improving that machine, as well as inventing new machines.

Already some of us are thinking in terms of "fixed cycle" machines which are capable of taking in the work and carrying it through all of the floor-to-floor operations and ejecting the finished product. This would require of the operator only that he put in and take out the parts. Thus, although the operator would put in and take out more parts, the fact that he does not perform any intermediate operations increases his productivity without making him work any harder.

We have dealt at some length with machine tools in discussing the role of increasing mechanization. This is only because the machine tool is the basic tool of all industry and is capable not only of producing other commodities and machinery but also of perpetuating itself through the production of other machine tools. It is the "king pin" of all machinery and its most efficient use sets the pace of mechanization.

Machines for extruding, forging, swaging, rolling, and so forth, are other important elements in mass production. In fact, only when the principles of mechanization are carried out consistently from mining, through the mills, through materials handling, through fabrication, through assembly, to inspection, can real unlimited production be realized.

Mechanization has tremendously advanced materials handling in recent years. The mechanization of the production line and the assembly line made possible such a spurt in production that the automobile was quickly placed within the reach of the average man. During the war, more and more emphasis in inspection was laid on mechanical "inspectors" such as the photo-electric cell. In fact, the need during the war for more factory manpower than had previously been utilized, and as a result "green" hands, made the turning to mechanization wherever immediately possible more mandatory than ever. And in that crisis it worked.

In cutting tools and cutting oils alone, tremendous progress has been made in the last twenty years, but here too, this is only the beginning. Now we are faced with no enemy other than our own backwardness and reluctance to accept new ideas and new concepts. The principles of mass production are not peculiar to any one industry. Even in small quantity production it yields a lower cost per unit produced because of the minimum of wastage of material and the time of the workman. Mass production affords the greatest gains when there is as complete a mechanization of operations as possible. This is achieved through design simplification in keeping with efficient utilization of existing production techniques which should be continuously advanced, and standardization of component parts, as well as standardization of as much of the tool engineering that our production brains can devise.

Standardization in itself is not a freezing of progress, since it can endure under our system of free enterprise and competition only so long as it serves an economical purpose. Standardization of jigs, fixtures, and cutting tools is already under way and some of the results have been promulgated by the American Standards Association. Here is the faint beginning of applying mechanization to as much of engineering production problems as is possible. But, here again, this is only the beginning.

Aircraft and Mechanization

This problem is ever before us to be solved in a new way, in a better way: Mechanization, a more efficient and less costly way of holding the work, machining the work, guiding the cutting or forming tool. It is a never ending process.

The unlimited possibilities of mass production techniques were vividly demonstrated in the airplane industry during the war. Until that time, the strict accuracy and quality of the work was achieved by the comparatively laborious process of much handwork and overly extreme limits. When manufacturers undertook to produce bombers, by utilizing mass production techniques, a hue and cry was raised that by its very nature the airplane and its engine could not be subjected to mass production. It was too special, called for highly skilled workmen, the precision required was too great. But interchangeable manufacture could produce just that precision and in a quantity that was never realized before under the custom built practices of the past. The unit cost of production went down; production went up.

Particularly in the airplane industry it was demonstrated that the advantages from the mechanization of assembly through jigs and fixtures could relieve the workmen of the

calculating and effort which was thus already provided by the production brain who designed the jig. Now the workman could concentrate on the welding and the rate of production was higher.

Another example of the meaning of mass production was the utilization of its techniques in the shipbuilding industry. Ships that were second to none slid off the ways in an ever growing quantity. Instead of placing the burden on the skills of experienced shipbuilding craftsmen, the emphasis was laid on welding machines and jigs. The materials used were handled and put in place by machines. The effort was toward more and more mechanization.

Top management in each company, of no matter what industry, must all realize the implications of the production and resultant wealth in real goods which can be achieved through interchangeable manufacture and the resultant mass production then made possible through mechanization. Here the Tool Engineer who is daily involved in actual production must go outside of his immediate sphere of activity and serve as consultant to industrial top management, to the design engineer, and to the consumer of the goods produced, the average American.

Standardization Regulates Schedules

One of the serious difficulties in the metal working industries is that production has until now been on a purchase order basis with too frequent standby for tooling up. Not only is this a waste of production potential, but the increased cost of frequent tooling is of necessity passed on to the finished product. Standardization of basic element in design, standardization of utilitarian products, and subassemblies would permit this industry to produce on a regular schedule and to utilize its capacity to the utmost. In return, the Tool Engineer and the machine tool industry must strive to achieve that progress which will permit more and a greater variety of distinct goods to be produced quickly and efficiently.

Mass production came about through division of labor, specialization, and finally mechanization which flowered in interchangeable manufacture. Division of labor and specialization were first applied to the manual work of men. Later, under mechanization, skills were transferred to machines. Under interchangeable manufacture the potentiality of production in the division of machine activity and the specialization of machines was realized. This in turn made possible cheaper and more efficient sources of power which increased the trend. In 1900 scientific industrial management came into existence and, for the first time, the concept arose of a system of factory mass production, with a division of activity between factories and specialization within an industry based on interchangeable manufacture.

Now, the time has come for a more intensive and complete utilization of machines and production brains and techniques. Only a short time ago, American manpower and American industry demonstrated their ability to defend our way of life. Our country, founded on individual enterprise and dedicated to democratic freedom, gave conclusive evidence to the world that this land of mass production is a factual reality and not a dream of wishful thinking. Surely, the brains, the hearts, the skills that fought a great war exist to solve our immediate economic problems and our long term economic policy.

Production unlimited and enduring prosperity are ours for the making.

By Karl Stad

MASTER TOOLING DOCK FOR AIRCRAFT

A MASTER TOOLING DOCK, successfully used by Consolidated Vultee Aircraft Corporation for military aircraft tooling purposes during the latter stages of the war, is now available to aircraft manufacturers and other industries. License rights to its use will be through the firm of Leland A. Bryant and Associates, located at 9660 Heather Road, Beverly Hills, Calif. The licensing firm is composed of Bryant, inventor, and D. L. R. Pratt, the latter formerly assistant to Convair's executive vice-president.

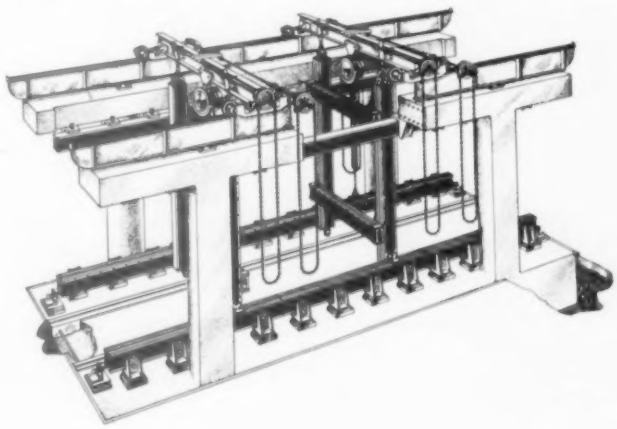
The original tooling dock so speeded tooling, for new types of commercial and military aircraft, at the San Diego division that other docks were installed in other Convair plants throughout the country. Thus proven, this fast and accurate method of tooling is expected to find wide application throughout the aircraft industry and other fields where special tooling problems present themselves.

Essentially, the master tooling dock is a 3-dimensional locating and positioning device, of which the key elements are three sets of coordinated straightedges. One fixed longitudinal straightedge establishes length, another—vertically movable—establishes height, while another, transversely movable, establishes width. Longitudinal members are from 20 to 80 ft. in length, with the other members usually 10 to 15 ft.

The dock makes possible the construction of large assembly tools directly from engineering templates. Such measuring devices as tapes, levels, transits or piano wires are not required. By this system—termed "physical geometry" by the inventor—all geometric calculations in the shop are likewise eliminated.

As applied, master assembly fixtures—which consist of two straightedges (of the type used in the tooling dock) set at convenient height—can be used for building prototypes. By this means, the prototype is not only constructed directly from templates, but the necessity for ordinary holding fixtures or "picture frames"—is obviated. As applied, the device has effected a solution to the interchangeability problem in the fabrication of large units.

Drawing shows features of the Master Tooling Dock. Fixed and movable straightedges are indicated in black.



By Howard Coonley[1] and P. G. Agnew[2]

The Role of Standards in the System of Free Enterprise*

A Study of Voluntary Standards as Alternative to Legislative and Commission Control. Prepared by Request of Temporary National Economic Committee

Part One of Two

INDUSTRIAL AND BUSINESS MATTERS have come to occupy the center of the governmental stage. It is said that three-fourths of present day legislation deals with business problems. Our courts are crowded with masses of these problems, a large part of which are too technical for them to handle well. The almost innumerable commissions which have been created solely to deal with such questions are equally crowded.

Fundamentally, these problems, which arise from economic struggles within and between industrial groups, involve the adjustment of claims of "rights" and the infringement of "rights" which are continually being put forth in the clash of conflicting economic interests. These problems are increasing in number, variety, and importance with the economic and social changes which have been taking place with increasing rapidity since the first world war.

Will these problems be handled in the future primarily by governmental agencies, or will they be handled in large part by voluntary, cooperative methods under industrial leadership?

One phase of this far-reaching question—whether the authority of federal administrative agencies should be curtailed—has become the subject of widespread controversy. It has been debated extensively in Congress, and it is the subject of a recent extensive report of the Attorney General's committee on the matter.

It is the purpose of this paper to outline some of the concrete accomplishments of the voluntary, cooperative method in the field of standardization, and to examine the general trend.

The importance of standardization in the national economy and as an instrument for the solution of innumerable problems and difficulties which would otherwise grow into industrial, social and political controversies and dislocations, and therefore liable to become matters of legal regulation, is not generally understood. While it is generally recognized that standardization is essential to mass production, and that it has been extensively used for this purpose by many American manufacturers, most business leaders apparently regard it as a purely technical matter which has only minor significance. Hence it is desirable to examine the standardization method, how it operates as a control, and to compare it with the legislative method, and the method of commission control.

The Consensus Principle

It is a commonplace that law, to be effective, must either be based upon thoroughly established custom, as was the common law, or it must be based upon a common understanding and a common purpose of the great majority of those concerned. Effective law is but one type, though an important one, of a real consensus, or at least of a real acquiescence, which means a common understanding, common purpose, and common consent.

Industrial customs and trade practices, or at least the more important of them, are, in a very real sense, industrial "law" no less than are statutes and the common law. Often more potent than much of the legislation on the statute books, they constitute a powerful system of controls which become generalized "law."

Most of these controls have come about by more or less unconscious evolutionary processes, but more recently they are being brought into existence in innumerable instances by deliberately planned, cooperative effort. As typical of these conscious, cooperative "law-making" processes there may be mentioned:

The numerous codes of ethics that have been adopted by commercial, industrial, and professional associations. While these have fallen far short of enthusiastic predictions made for them a few years ago, chiefly because they have not been sufficiently specific to serve as criteria in adjusting individual cases, they have attained to some importance.

The rules and principles laid down by "industrial czars," which become mandatory rules governing important relations within the group concerned, for example in professional baseball and in the moving picture industry.

Principles and working rules governing relations between employers and employees, developed by such means as "impartial chairmen," direct negotiations between employers, and various types of labor organizations.

The voluntary rules developed by business groups under the trade practices conferences of the Federal Trade Commission.

Much of the work of the trade associations.

Rules and machinery for the arbitration of commercial disputes. This method is in wide use as a substitute for litigation.

The standardization movement.

Most of these are based essentially, though with many variations, upon the simple process of the various parties at interest facing each other, and the common problems, across the council table, developing the facts, and sticking to the problem until agreement is reached upon the principles and the lines of action to be followed.

Standardization

Standardization is the establishing by authority, custom, or general consent, of a rule or model to be followed. In its broadest sense, it applies not only to such matters as weights and measures and material objects, but it permeates most fields of human activity. Folk-ways, taboos, moral codes, ceremonies, educational procedures, social and business customs, industrial practices, even language, are all forms of standardization. The main use of the term standardization is, however, in connection with technology, industry, and business, their products and processes.

Every industrial plant is carrying on standardization of its own products and processes, and its competitive success depends largely upon how well it has studied and solved

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The Editors

these problems. Standardization within the plant has been the essential factor in the development of mass production—which is the most important contribution which this country has made to the development of industry.

Some of the more important phases of the movement have to do with dimensional standardization to secure interchangeability; concentration on the optimum number of types, sizes and grades of products; specifications as a basis of purchase; methods of making acceptance tests for materials and apparatus; safety codes for the protection of workmen; building codes; traffic standards; nomenclature, definitions of terms commonly used in specifications and contracts.

All of these are matters which are involved in the relations between buyer and seller, and between competitors, and hence frequently become subjects of litigation in the courts, and of adjustment through other arms of government, particularly commissions and administrative offices. The purpose is not so much to settle controversies as to simplify and clarify matters so that controversies shall not arise.

For example, loose phrases in describing products, such as, "all materials shall be of best commercial quality," and "good workmanship shall be required throughout," which are even yet frequently used in contracts, are but invitations to the courts. In a wide range of products, such loose phrases are giving place to definite, clear-cut specifications, which may be interpreted in the acceptance or rejection of material without danger of misunderstanding by any competent engineer or testing laboratory.

The purpose is to set forth so clearly the technique by which acceptance tests are to be made that any competent inspector can determine readily and definitely whether the material comes up to contract, or guarantee, or not.

Often in commercial practice things which at first seem extremely simple turn out to be not so simple. What could seem simpler than to decide whether a piece of shafting is 2 inches in diameter? Yet, if nothing more is specified, a buyer may attempt to reject the material, claiming it inaccurate, no matter how accurate it may be, since it is impossible to make a shaft exactly 2 inches in diameter on account of unavoidable inaccuracies of workmanship. On the other hand the seller may attempt to supply material so inaccurate as to be unusable, asserting that it is "commercially accurate." The solution consists in agreeing upon just how many thousandths of an inch departure from the ideal size shall be allowed for unavoidable inaccuracies of workmanship under normal conditions of commercial production. (The amount thus allowed is technically known as the "tolerance.")

Standards as Definitions

Another important line of activity which tends to reduce the work of the courts is in connection with definitions of technical terms used in specifications and contracts and in general industrial transactions. To realize the importance of this, one has but to recall that a large part of the civil cases with which courts deal hinges upon the exact meaning of words and phrases.

As a matter of fact, a large part, perhaps the greater part of standardization, is essentially agreement on definitions. When we agree on specifications for cement we are really agreeing on what we mean by cement, so that we may telegraph, "Send one thousand barrels of cement according to specification," with the full assurance that there will be no misunderstanding of the requirements.

The same is true of methods of test, of grades and grading rules, and of methods of rating machinery and apparatus. It took a vast amount of technical study and many years of negotiations before a "10 horsepower motor" had the same meaning when used by competing manufacturers.

All buying and selling in which goods do not come under the actual eye of the buyer must necessarily be based upon some sort of standard. Most such standards are unwritten, simple, and crude, often being no more than a two-party understanding such as, "Like the one I bought of you the last time." At the other extreme, all of the great basic commodity markets are dependent upon standards which are, in most cases, well worked out, are nationally accepted and used, and may even be subject to legal definition. In the absence of such standards, the buyer would himself have to judge the wheat, corn, cotton, or copper with his own eyes. A safety standard defines just what hazards shall be covered by the safety features of a machine, or by safe practices in an operation. In each case a standard enables buyer and seller, or the parties to any other undertaking with which the standard deals, to speak the same language.

It is readily seen that all these features of the standardization movement partake of the nature of effective human law in its generic sense, that is, of principles of conduct, based upon a sufficiently broad consent or acquiescence of the groups concerned to assure general compliance with them.

Standardization Methods and Machinery

Most standards have come about through a more or less unconscious evolutionary process. Nearly all standards were developed in this way until within the last hundred years.

The conscious process of standardization in industry was first applied to engineering matters, but has been extended to foods and other agricultural products, in fact to innumerable products of farm, forest, mine, and sea. It helps to channel these materials through the many stages of manufacture. It has been concerned predominantly with producer goods.

There is an interesting analogy between this earlier growth of the standardization movement, largely unconscious, and the development of the fundamental principles of Anglo-Saxon law through the common-law process, which was unplanned and largely unconscious.

The standardization movement has been slowly systematizing its machinery and standardizing its own methods. In the past most companies have handled these matters in what may be termed an unconscious way, implicitly as part of other activities, following the lead of other companies, etc., without clear-cut analysis or organization for the problem.

Group Standards

The great growth of company standardization and mass production during the last half of the nineteenth century gave rise to group standardization which, with a few notable exceptions, has been a development of the present century. There are literally thousands of such group standards, most of which have been developed by technical societies and trade associations.

The present extensive use of electric motors and lamps has been made possible by collective standardization of such fundamentals as voltages and frequencies, and of such details as the interchangeability of lamp bases and sockets.

Probably the most important of all group standards is that of the standard gage and the system of interchangeable brakes and couplings, which has made possible interchange of rolling stock between railroads. Such interchange is necessary to our national railroad transportation system, upon which our whole economic and industrial structure rests.

National Standards

Just as standardization by individual companies led to standardization by groups, so group standardization has led to national or inter-group standardization among industries as a whole. In this, technical societies and trade associations

play the same role as do the individual companies in group standardization.

The methods used in formulating group, or association standards are very simple, being essentially committee methods. Customarily a standard is issued only when supported by a majority so substantial as to approach unanimity—almost never on a mere majority vote as so frequently happens in legislatures. Generally, final action is by the governing board of the association, but not infrequently it is by vote of the entire membership. Most of the more experienced associations have safeguarded their procedure to assure the most thorough consideration of the proposed standard before its promulgation.

Necessarily, national standardization requires the correlation of the work of the interested groups through a national clearing house agency. At the beginning of the present war, there was such a national body in each of twenty-six countries, including all of those countries which are highly developed industrially. All but one of these have been organized during or since the World War.

Our own national body, the American Standards Association, was organized in 1918. It is a federation of 73 national organizations, composed of seven departments and three other major agencies of the Federal Government; thirteen engineering and professional societies; and fifty national trade associations, including most of the heavy industries that are active in standardization work.

Developing a Consensus

The chief function of the Association is to provide the systematic machinery through which all the groups concerned with any particular standard participate in its development.

As an example of the standardization method of getting a national consensus let us choose a specialized but relatively simple industrial problem, the protection of workmen in the use of grinding wheels. What are reasonable provisions for safety?

The work of formulating a safety code on the subject was carried out by a joint committee made up of representatives of all interested groups; the manufacturers through their national trade association; state commissions having regulatory authority over safety matters in the industries, or charged with the administration of accident compensation, through their national association; employing groups which are users of grinding wheels, through their trade associations; casualty insurance companies through their two national organizations; the workmen whom the code is designed to protect, the representation being arranged through the United States Department of Labor upon nomination by the craft organizations concerned; national engineering societies; technical bureaus of the Federal Government; and independent specialists.

In all, seventeen national organizations are represented on the joint committee, which has thirty members. After two years of painstaking work, unanimous agreement upon a complete code was reached. This was not accomplished, however, without encountering some serious difficulties and differences of opinion. Through patient and conscientious effort a solution of all these problems was found.

The code covers the general safety requirements to be met in the construction, care, and use of grinding wheels. Its authoritativeness is recognized by the industries concerned with their manufacture and use; all state regulatory bodies that have rules on the subject have adopted the code as their own regulations; and casualty insurance companies use it in recommendations to their insured. It has, in fact, become "the Bible" of the industry.

The code is kept up-to-date by revisions as new developments occur.

The backbone of the regulations of the various state governments for the protection of workmen consist of fifty such safety codes. Each code has been developed by the same general process and with the same care, through systematic cooperation of all interested groups. After substantial unanimity is reached and registered by action of the joint committee responsible for any particular code, the code is formally certified as the "American Standard Safety Code" for grinding wheels, or for punch presses, as the case may be. This is done by the central organization which serves as a clearing house or means of systematic cooperation in this national industrial standardization movement—the American Standards Association.

A safety code has been chosen as an illustration, not only because of its more direct legal implications, but because of the diversity of the interested groups.

Work on other types of standards is carried out by the same general method. The groups concerned with commercial standards such as specifications, grades, and dimensional standards, usually come under four categories,—producers, consumers, distributors, and independent experts. The number of groups interested in any particular project is surprisingly large, usually from ten to twenty in number. For example, twenty national organizations are participating through accredited representatives on a committee developing a series of standards for bolts, nuts, and rivets; thirty-two are on a committee on pipe flanges and fittings, and thirty-three on a committee on specifications for galvanizing. Even in so specialized a subject as railroad ties, twelve national organizations participated.

The Human Element

In standardization work the human element is far more important than is generally realized. In setting up standards, the human difficulties are usually much more serious than are the technical ones.

On the other hand, one of the chief functions of standards is to remove conditions which lead to controversies. As has been indicated, the lack of adequate standards is a prolific cause of controversy—parts that do not fit, supplies and materials that prove unsuitable because they have not been properly specified, goods that do not live up to sales representations. Such transition-point difficulties often result in feelings of resentment or of frustration on the part of the personnel involved, and thus give rise to controversies—often deep-seated ones. Indeed a goodly proportion of present-day industrial standardization, such as that carried on by the national standardizing bodies, is undertaken in the first instance to remove controversies. These controversies are usually resolved, or at least greatly mitigated, by the introduction of standards which solve the mechanics of the difficulty.

Most cooperative work on standards is undertaken before controversies reach an acute stage. This, however, is not always the case. An example will illustrate the spirit in which such situations are approached.

Some years ago the gas industry proposed to the American Standards Association that there should be national specifications for cast iron pipe. When the manufacturers were approached they said that it would be useless to talk with the engineers of consumer companies who were impracticable theorists. The engineers in turn said that it was hopeless to try to cooperate with the manufacturers who had been working off inferior pipe on them for a dozen years and whose willingness to live up to specifications they doubted. It was a year before it seemed safe to invite them to sit down in the same room to talk things over. After much talk they agreed to develop new specifications cooperatively. A wise and experienced engineer agreed to take the chair-

manship of the technical committee, but only upon three conditions:

1. They must agree to agree upon what they did agree upon and what they did not agree upon. That is, they must first agree upon the exact point at which the road began to fork. This was done, and agreement was reached upon what the moot questions were, one of which was the accuracy of a certain formula.

2. They must agree upon why they disagreed upon these moot questions. After long discussion they decided that there were insufficient known facts to give the answer, and hence one man's opinion was as good as another's.

3. They must decide upon what they were going to do about it. The final result was that the manufacturers raised some $70,000, which was expended in large part under the general direction of the engineers, and the necessary facts were obtained. With the facts at hand, the controversies disappeared.

The Three Fundamentals

This also illustrates three principles that are followed by the American Standards Association in order that a consensus may be established in the case of each standard. First, every group substantially concerned with a standard has an inherent right to participate in deciding what the provisions of the standard shall be, so that the standard shall represent a true national consensus.

Second, the questions are broken down into parts small enough so that each part can be handled by a committee made up of representatives of the groups concerned. Such committees are like a legislature, but organized along industrial instead of geographic lines.

Third, decisions are not made by simple majority vote, but every effort is made to thresh matters out so thoroughly that a decision is reached which is unanimous or nearly so.

An idea of the extent to which the national stage of the movement has developed is given by the fact that over 500 national organizations, industrial, technical and governmental, are cooperating under the auspices of the American Standards Association on some 600 projects, 425 of which have been completed and issued as approved standards. Three thousand men and women are serving on its committees. Only a very small part of the possible field has, however, yet been touched.

Industry-Government Relations

It has often been suggested that in this standardization work, an ideal relationship between industry and government has been developed, namely, that the government departments participate in an undertaking on precisely the same basis as that of any other organized technical, industrial, or consumer group. This means that they participate in proportion to their direct concern with the problem in hand, and to the extent that their technical resources enable them to contribute to the solution, rather than by assuming the direction of the whole undertaking. Fifty bureaus of the Federal Government are officially represented on American Standards Association committees.

Comparison of Common-Law, Statute-Law and Commission Method with Standardization Method

It is instructive to compare these cooperative methods that have been developed in standardization work with the common-law and the statute-law method of arriving at a national consensus.

To see how impossible it would be for the common-law process to work under the rapidly changing conditions of modern industry, one has but to consider a simple case of the common-law process, for example the rates at an old English inn. A traveler, dissatisfied with the charge demanded by his innkeeper, might have recourse to a court. Through long series of decisions of many cases in many courts, each decision serving as a precedent to be cited in other cases, there had early emerged one of the principles of the common law, namely, that the charges in such cases must be reasonable—and reasonable rates had come to be defined as the rates customary in inns of that class. As a part of this evolutionary process of law-making, a regular machinery had been developed for determining what was customary, namely, the testimony of inn keepers and of travelers as to what rates actually had been charged in specific cases.

The common-law has been one of the strongest and most fundamental forces in Anglo-Saxon civilization. Its slow, evolutionary growth made possible so perfect an adjustment to the conditions of the civilization with which it developed, that few forms of social control have exceeded it in power and effectiveness. Perhaps only the control exerted by folkways has been more powerful. The method of its growth was closely akin to the slow, remorseless process of natural selection by which nature arrives at types. The common-law method did arrive at a workable consensus, however painful and costly to the individual the grinding of its slow evolutionary process.

The statutory method has in large measure replaced the common-law method in the making of laws. The principal reasons for this have been: the necessity of more rapid adjustment to meet changing industrial conditions; the need for greater clearness and definiteness than was possible in common-law; and the attempt to avoid the enormous costs, human and economic, of the older method.

To reach a national consensus through the statutory-law process is an extremely slow and difficult matter. It is all the more so on account of the fact that legislation on most industrial matters falls within the jurisdiction of the legislatures of the forty-eight states, even though Federal jurisdiction has been enlarged through recent court decisions.

Since few, if any, members of a legislature have adequate knowledge of such a problem, the initiative and the general direction of legislative movements of the kind may be in the hands of interested people outside the legislature—in short, in the hands of the lobby. In state after state the question is fought out before legislative committees by those groups sufficiently interested and alert to participate.

In the legislative mill many specialized problems may become involved in the game of partisan politics. In nearly all cases in which the legislation deals with technical or specialized problems, the overwhelming majority of people are necessarily misinformed both of the existence of the problem and of the attempted legislative solution. To a large extent the same is true of most of the legislators themselves.

With such conditions in each state, anything approaching national uniformity becomes extremely difficult, often impossible. The experience of the National Commission for Uniform Legislation, which is an official body, has shown that even in the case of legislation which meets with general favor, at least ten years are required to attain uniformity in the more important commercial states.

The legislative method, in short, is not a suitable one for the solution of innumerable specialized and more or less technical problems that arise in the development of industry and business. This does not reflect upon either the ability or the probity of legislators as such, any more than the statement that hammer, chisel and saw are not suitable tools for the making of watches reflects upon either the ability or the probity of carpenters as a class.

End of Part 1. Part 2 will follow in April, *The Tool Engineer*.

By E. H. Wheeler

The Case for Fundamentals

Experienced Tool Engineers, as Well as Beginning Students, Can Benefit from Review of Articles Dealing with the Fundamentals

THE FOLLOWING SYNOPSIS of the writer's personal viewpoints, regarding the profession of tool engineering and some of its fundamentals, is the result of considerable reading; and rather extensive contact with tool engineering drawings made by beginners in the profession, and by men who have been in the profession for many years, as well as by several different design and engineering companies.

The writer was surprised to note, in *The Tool Engineer**, that a minority of readers feel that some of the articles being published are entirely too elementary. It appears to me that these readers seem to be overlooking the fact that many new men, joining the American Society of Tool Engineers every year, may have had very little broad experience in the tool engineering field. Also, many students are joining with the desire and expectation of increasing their knowledge and ability, as much from their contact with the Society as from the instructors who are teaching them.

E. H. Wheeler **gained practical experience with the Louden Machinery Company, Fairfield, Iowa, and was subsequently employed by the H. D. Hudson Mfg Co., Chicago, and the Interstate Power Co., Dubuque. He joined the LaPlant Choate Mfg Co. in 1941, where he was in charge, under direction of the chief tool engineer, of all tooling for bomber strut production. He is currently in charge of LaPlant Choate scraper production at the Luba Mfg Co., Benicia, California.**

These inexperienced members have a right to have at least a portion of *The Tool Engineer* devoted to the fundamentals of good tool engineering. And, since many of the oldsters in the field are sometimes prone to overlook or even neglect the fundamental rules of our profession, it would be to their advantage to review articles concerning these fundamentals.

There has been an excessive amount of literature written regarding tooling for mass production. Some articles have explained the procedures followed, the methods employed, the operations necessary, the machine tools used, and the tooling required. Such articles have usually been well supplemented with illustrations, photographs and minute details of each tool.

After reading a lengthy article of this type, with the hope of finding something helpful, the Tool Engineer often discovers that the problems discussed and solved are entirely different from the ones he is immediately concerned with. He then realizes that the only knowledge derived, which may be of much immediate use, is concerned mostly with fundamentals. It must be remembered, of course, that articles of this type do materially increase the engineers' background of useful knowledge.

There has definitely not been enough literature written regarding tooling for small production runs. Thousands of small plants and shops throughout the country produce small and large items in quantities that could never be considered under the term "mass production." And, naturally, the majority of these items or products can be produced more economically by the use of thoughtful, well designed tooling.

Such tooling for small production runs seems to be overlooked to some extent by certain tool design and engineering companies now offering their services to the public. The prime factors in tooling for small quantities is efficiency and economy. Machining of unnecessary parts of a jig or fixture, and pleasing appearance are unimportant since such features add only to the cost of the tool and not to its adaptability. It seems that any number of men can do a good job of tooling for mass production but try and find an equal number adept at tooling for small production runs.

In most cases, a simply constructed jig or fixture, with only the necessary locating points or surfaces machined, will create a saving in the cost of producing small quantities; whereas, "over-designed" fixtures would never pay for themselves due to the excessive design and construction cost. Some of the companies offering tool engineering services seem prone to design tools embodying pleasing appearance and unnecessary machined surfaces which make the cost of the tool prohibitive for many manufacturers dealing in small quantities.

These companies could be of far greater service to the small manufacturer if they would eliminate unnecessary features and design efficient tools at the lowest possible cost. The owner of a small shop is usually unconcerned with the appearance of a tool as long as it performs its function efficiently.

Tooling for Welding

Also, more literature should be written explaining the fundamentals of tool engineering for welded products. Welding proved itself during the war years; and, in these postwar years more and more products that were formerly assembled by screws, bolts or rivets will be assembled by welding. The same fundamental rules apply to fixtures for welded construction as for any other construction, except that there are some additional rules which must also be remembered.

For example, locating points should be machined with loading and unloading made fast and simple. Sufficient clamps must also be provided. However, on a fixture for a welded assembly it is usually necessary to provide more and stronger clamps than are necessary on fixtures for other types of assembly. The dimensions to locating surfaces should be given from a common construction hole, or from the same machined surface.

It is also advisable and advantageous to dimension the locating points of the fixture to correspond with the points dimensioned on the parts' drawing. If possible, avoid dimensioning the locating points, or surfaces of the fixture differ-

*The author refers to a comment in "Andygrams" August, 1946, issue, *The Tool Engineer*.

This article was originally written as a letter to the editors; however, the comments were so thought provoking that, on request, the author expanded them into an article. We believe that it presents an excellent case for "Fundamentals of Tool Engineering."

The Editors

ently than these points are dimensioned on the production drawing. Such dimensioning requires the use of trigonometry by both the designer and the checker, and therefore adds to the possibility of error, which in turn increases the designing and checking time.

When designing a fixture in which parts are to be assembled by welding, the designer should realize that the fixture must be rigid. The stresses set up by welding are extremely severe and unless the fixture is made solid and rigid, and firmly braced, there is obviously a possibility of the locating surfaces and points being changed due to the stresses exerted by the parts being welded. In many cases, a welded assembly upon cooling will shrink or warp considerably, and this must be taken into consideration when designing welding fixtures.

The locating points of the fixture can be extended beyond the dimensions for the finished assembly, to allow for the shrinkage that will occur, and thus produce the cooled assembly as per the dimensions on the production drawing. Considerable warpage can be eliminated by making the fixture so that it will pre-bend the parts that are being welded, opposite to the direction they will warp upon cooling.

By careful study and proper welding procedure, it is often possible to pre-bend the exact amount necessary to produce a straight part upon cooling and thus eliminate costly straightening operations.* When the parts being assembled are surrounded by locating points or surfaces, a means must be provided whereby some of these points can either be removed or drawn back from their locating position to facilitate removal of the finished assembly. The majority of fixtures for welding assemblies should be mounted on trunnions so that the various welds can be positioned most advantageously. In this manner it is possible to avoid almost all overhead and vertical welds.

The writer's personal viewpoint, regarding the additions to fixtures after the fixtures have been put into use, is that such additions are advisable. All Tool Engineers should spend considerable time in the shop watching tools, jigs and fixtures in operation; also the men using the tools should be encouraged to make their desires and recommendations known to the Tool Engineers.

Tooling is no exception to the adage that "nothing is perfect." There is always room for improvement on any tool that has been made or designed, and in many cases the men using the tool will know what additions or deletions will most improve its use.

Naturally, "crackpot" suggestions must be eliminated and every addition should be given considerable thought before being employed. In most cases, the Tool Engineer can easily visualize the advantages or disadvantages of such additions and can decide which additional clamps, locators, fool-proofers and other small parts will improve the ease of assembly and operation enough to more than pay for themselves.

The writer does not necessarily believe that all small additions to fixtures, to facilitate assembly and operation, have to be shown on the original drawing. It would be far simpler and less costly to take a few snap shots of the fixture and its additions after all additions have been completed and approved. These snap shots could be filed under the drawing number, either with the drawings or in a separate file. A detail close-up snap shot could be taken of all intricate or unusual additions.

If similar additions were to be used on future fixtures, it would be a simple matter to locate the fixture and take any necessary rough measurements that might be used. In many cases, additions of similar type but of different size will be wanted, and in these cases the less costly snap shot will be just as adequate as a detailed dimensioned drawing of the addition since the same dimensions could not be used anyway.

The writer wants to emphasize that the men who are just starting in the profession of tool engineering should be allowed to spend at least a small amount of time in the shop every week watching the fixtures on which they have worked and other fixtures in use. The basic knowledge and self satisfaction gained in this fashion are immeasurable. As an over-all rule, professions are based on fundamentals; and, certainly, those of us in tool engineering should never consider ourselves exceptions to that rule.

*This phase of pre-distortion was discussed in the article "Welding Fixtures for Mass Production," by A. E. Rylander, in the December '46, and January '47 issues of *The Tool Engineer*.

Improve Sequence-Weld Timers

CONTROL DIVISION of General Electric Company has redesigned its line of sequence and sequence-weld timers for resistance welding, permitting quick change of the welding sequence, easy inspection and maintenance, as well as remote operation. An improved electronic timing circuit makes possible consistent welding speed essential to high-production welding with short timing intervals.

Sequence-Weld Timer, CR7503-F185, for resistance welding. Oblique front view showing front panel about to be assembled to rear panel.

The sequence timer coordinates the mechanical operation of an air- or fluid-operated spot or projection welder with the the flow of welding current, as determined by a synchronous-precision weld timer. For less exacting applications, the sequence-weld timer provides the necessary control of both mechanical sequence of operation and non-synchronous control of weld time.

All electrical connections between the front and rear panels are made by plug connectors so that the front panel, or timing control section, can be removed in less than a minute and placed in another machine, thus permitting quick replacement of any one of a number of similar timing control sections with a single spare unit.

Features for simplification of routine inspection and servicing include a completely redesigned wiring system in which most of the small resistors and capacitors are mounted on a terminal board; use of standard industrial-type relays; and a hinged front panel which cuts inspection time.

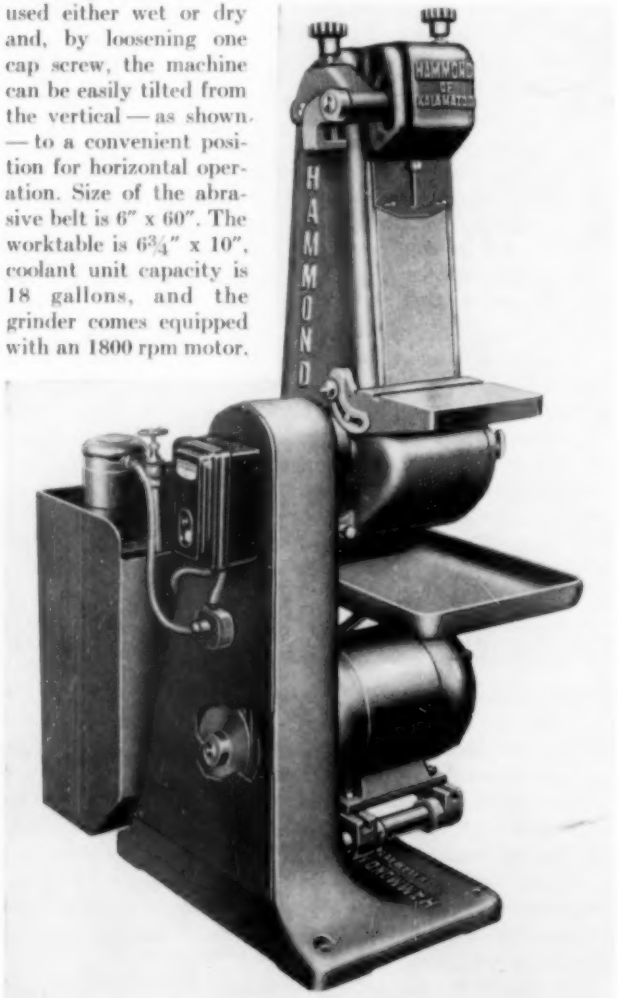
The initiating circuit, normally 115 volts, can be easily changed to 24 volts, and a two-stage foot-switch can be added at any time. All 60-cycle panels are suitable for operation on 208, 230, 460 or 575 volts, 50 or 60 cycles, and panels are available for other frequencies.

By Fred W. Steiner

Reviews and Previews

INCREASED USE OF BELT MACHINING techniques has centered attention on Hammond Machinery Builders, Inc., of Kalamazoo, Mich., makers of abrasive belt grinders, polishing and finishing machinery. Model VH-6 Wet-n-Dri Abrasive Belt Grinder, shown in adjacent photo, is designed for grinding, polishing, deburring, beveling and similar operations on metal, as well as for use on other materials such as plastics, ceramics, glass and wood.

The grinder can be used either wet or dry and, by loosening one cap screw, the machine can be easily tilted from the vertical — as shown — to a convenient position for horizontal operation. Size of the abrasive belt is 6" x 60". The worktable is 6¾" x 10", coolant unit capacity is 18 gallons, and the grinder comes equipped with an 1800 rpm motor.



AN ADDITIONAL CONTRIBUTION, to better belt machining, is the popular Hammond Model No. 5 Abrasive Belt Grinder-Polisher with horizontal platen. As shown at right, ready for operation, this machine can be equipped with one frontstand, two backstands, a 1 hp motor and 60" length endless abrasive belts.

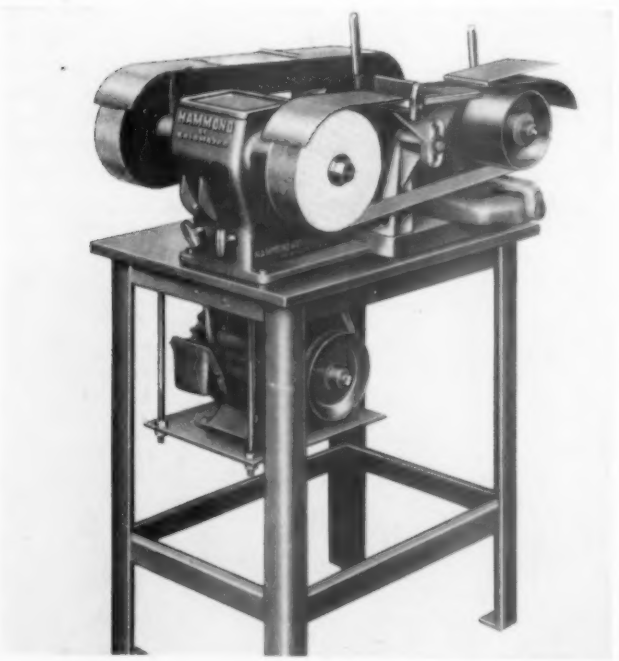
ALSO, FOR CONVERTING any standard polishing lathe into a high production abrasive finishing unit, Hammond has now made available an improved Model No. 3 Backstand. As shown in the small photo at upper right, this backstand has a 12" diameter idler pulley, with a 7" face, and is designed to accommodate belts up to 6" in width.

TWO NEW MODELS—The latest refinements of the Hammond line of polishing and buffing lathes include Model "VROL" (not shown) which is a polishing and buffing lathe for color buffing, light cut buffing and polishing. This machine features a *variable speed*-single spindle and has a speed range of 1500 to 3000 rpm. Instant speed changes—while the lathe is operating—are accomplished by use of a conveniently located dial control. The spindle overhangs 8", to permit handling of bulky parts, and the 3 hp motor, mounted in the base, has a sturdy V-belt drive.

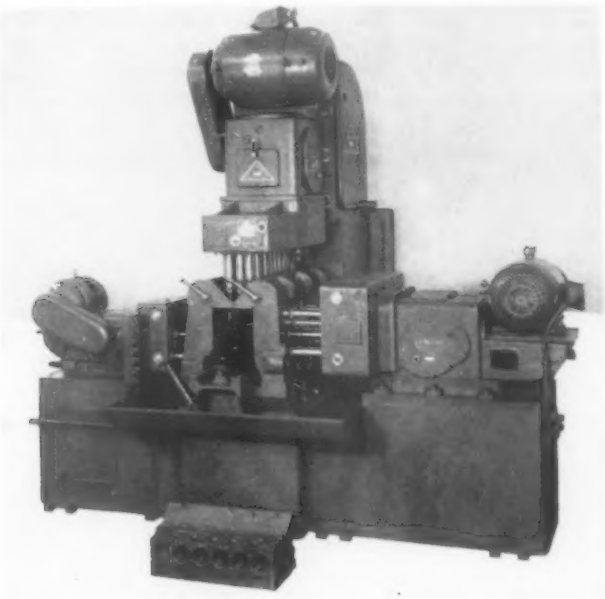
THE OTHER NEWLY designed machine is the Model "ROL" (also not shown) which is a *single speed*-single spindle polishing and buffing lathe, powered by a 2 or 3 hp motor. Spindle speeds can be changed by replacing motor sheaves only and, like the previously mentioned Model "VROL," has an 8" overhanging spindle.

This new model has the long-lasting features for which Hammond is noted, including easy-to-remove V-belts, and ball bearings in spindle. A combination spindle lock, brake and switch, which eliminates the troublesome spindle lock pin, can be supplied as an extra. A single lever simultaneously cuts off motor current, applies the brake, and locks the spindle for wheel removal. This insures that the motor cannot be started until brake and lock are released.

At LEFT, the Model VH-6 Wet-n-Dri Abrasive Belt Grinder. BELOW, Model 5 Abrasive Belt Grinder-Polisher. At RIGHT, Model No. 3 Backstand.



A 3-WAY TAPPING MACHINE, by LeMaire Tool & Manufacturing Company of Dearborn, Michigan, is shown set up to tap 19 holes on the right side of a cylinder block, 33 holes on top, and 5 holes on the left side. Of particular interest is the fact that this machine is being used to tap the holes which are drilled by the LeMaire 3-way Drilling Machine presented in the January '47 issue, page 69, *The Tool Engineer*.



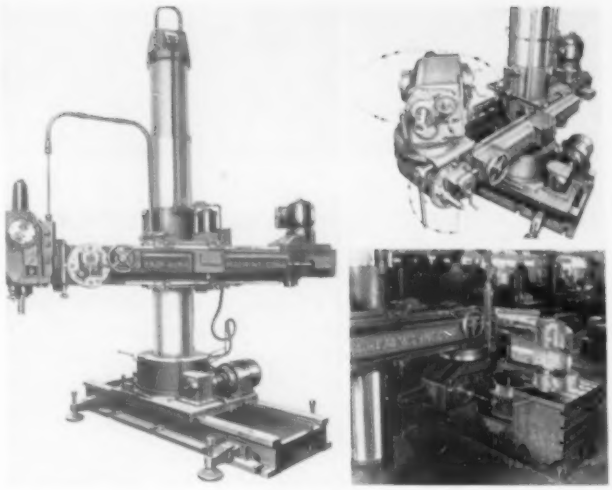
The machine shown here consists of a one-piece base, a standard LeMaire No. 150 Lead Screw Tapping Unit and a No. 200 Tapping Unit mounted horizontally at left and right ends respectively, and a No. 200 Tapping Unit mounted on a standard column at the rear of the machine.

Each tapping unit is equipped with multiple spindle heads. A tunnel type fixture is provided, having wear strips, crank bore guide, and adjustable stops to manually load the part to primary position. Manually operated retractable pins provide final location after engaging locating holes in the part, while hand operated cam locking toe clamps hold the work securely over both sides of the top. Production rate is approximately 86 pieces per hour at 100% efficiency.

UNUSUAL VERSATILITY features the series 125 Portable Universal Horizontal Drilling and Tapping Machines, recently introduced by Kaukauna Machine Corp'n, Kaukauna, Wis. These machines are offered in three models—125-U (shown) which is completely universal and which will drill holes in any conceivable angle, and the 125-HR and 125-H, which are horizontal machines. All of these models effectively combine conventional radial and horizontal drilling, plus tapping operations, in one machine.

The Model U is designed to perform drilling, reaming, counterboring or tapping operations in any plane within the minimum and maximum limits of travel or movement of the machine units. The spindle has a 12" continuous travel and, since the head swivels 360° in either a vertical or horizontal plane operates in any conceivable angle.

The headstock is positioned on two individually controlled axes, permitting the head to swivel 360° on a trunnion which, in turn, swivels 180°. All this is shown in the detail photograph, upper right. In addition, the rail may be raised or lowered by power and may be positioned at any point suited to a specific operation. It may also be swivelled through 360°, to perform machining operations at any point around the machine.

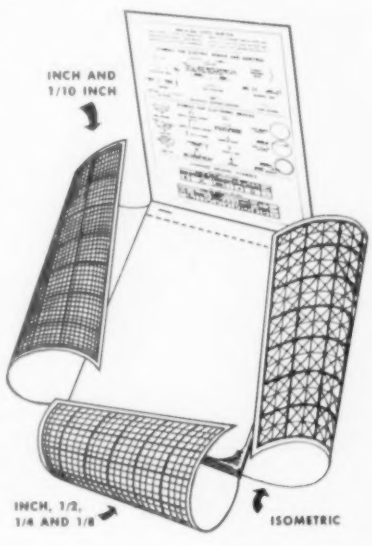


These machines are completely portable, by crane, thus bringing the machine to the work and considerably reducing costly multiple setups and expensive hand drilling and tapping operations. A lifting bail, at top of column, provides for crane hooking, while levelling jacks compensate for any unevenness of floor. To further increase the versatility of this series of machines, work may be located and held on a Kaukauna Model 700 Indexing Table, which permits the work to be quickly rotated to present five different surfaces to the machine.

The spindle speed unit is located at the opposite ends of the rails and encloses the speed gearing controlling the spindle speeds. Drive to the spindle is through a 9-speed gear change box, with direct drive to the spindle. The levers are always within easy reach of the operator, regardless of head position. Handling is further facilitated by dual controls within easy reach.

ONE OF THE HANDIEST "tools" for the busy Tool Engineer, just recently introduced, is the Jiffy Sketch Scale Drawing Pad, offered by Jiffy Sales Co., 1840½ East 37th St., Cleveland 14. When it is opened up, the 9 x 12 inch tablet is cruciform in appearance, with the 75-sheet pad of transparent paper, in the center. Inside the four "legs," or flaps, are mechanical drafting standards (left flap); decimal equivalents of fractions (bottom); standard architectural symbols (right); and at top (shown) are various electrical, welding and electronic symbols.

By folding one, or the other of the three covers — left, bottom or right side — beneath a sheet of the transparent paper, you have a choice of inch and 1/10" scales; inch, ½", ¼" and ⅛" scales; or isometric, as desired. For the Tool Engineer who has to sketch layouts for design, at the desk or even out in the plant, this pad can be recommended as a real time-saver. Priced at $1.65 each, or $1.50 in lots of six or more.



GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

To Measure Bearing Clearance

As almost everyone knows, a loose shaft will "wiggle." The looser the shaft, the greater the wiggle; or, in other words, the looser the shaft the greater the so-called "clearance." However, comparatively few mechanics may realize that this "wiggle" can be utilized for determining the amount of clearance between the shaft and its bearing; and, what is more, that it eliminates the necessity of a micrometer or extremely fine measurements.

Take a shaft out of the bearing and measure its length L in inches. See three sketches. Then shove it part way back into the bearing, distance I, which we will call the "distance of insertion." Now move the end of the shaft from extreme to extreme. Call that distance the "distance of wiggle," D.

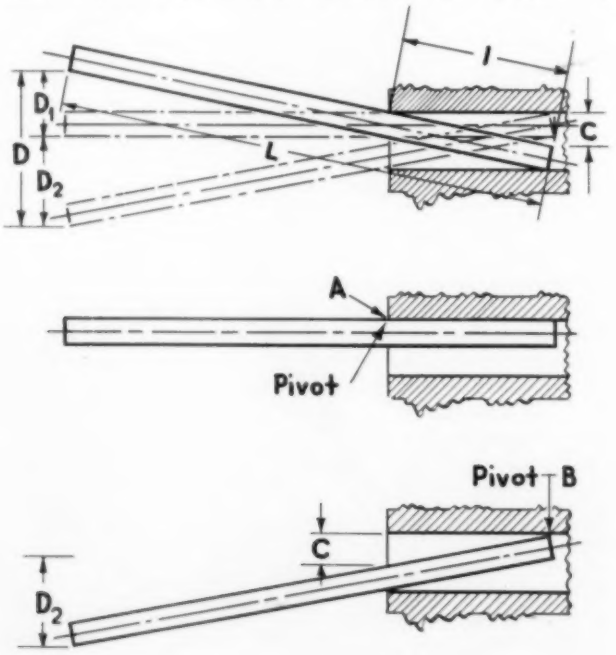
It is obvious that the distance D is directly proportional to the clearance. The greater the distance D, the greater the clearance. If there is no clearance, the end of the shaft cannot be moved. To be sure, if it is a long shaft, it can be deflected owing to the elasticity of the shaft, and this deflection should be considered if the shaft is long. In most cases, though, the shaft is short enough so that deflection can be neglected.

After making all of the measurements suggested above, multiply the movement distance D in inches by the insertion distance I in inches and call the product "A." Then multiply the length of the shaft in inches by 2, and from the product subtract the insertion distance in inches, calling the difference "B." Now divide "A" by "B." The result will be the clearance in inches.

TOP sketch shows shaft and bearing, with I = distance of insertion; D = distance of "wiggle"; and L = length of shaft.

CENTER view shows A as the pivot. Thus, $C : I :: D_1 : (L - I)$; whence $D_1 = C(L - I)/I = (CL - CI)/I$.

BOTTOM view shows B as the pivot. Thus, $C : I :: D_2 : L$; whence $D_2 = CL/I$. Now, $D = D_1 + D_2 = (CL - CI)/I + CL/I = (2CL - CI)/I$. Thus, $D = C(2L - I)/I$; and C (clearance) $= DI/(2L - I)$.



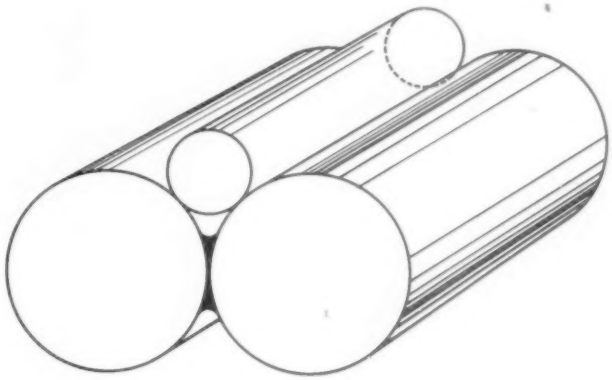
For example, if $D = \frac{1}{4}''$; $I = 1''$; and $L = 10''$; application of the above rule tells us that the clearance between the shaft and bearing is 0.01316 inch. It is obvious that this method is useful also for determining whether or not a bearing is out of round, and if so, how much. This is accomplished by measuring the distance D in several directions.

W. F. Schaphorst, M.E.
Newark, N. J.

Rugged V-Block

This simple yet useful "Gadget" is made from two pieces of cold rolled shafting welded together, as shown. About the only care required in the making, is to make sure that the two pieces are clamped down on a heavy plate, to insure parallelism. No further machine work is necessary.

Frank J. Peragine
Greater N. Y. Chapter, A.S.T.E.

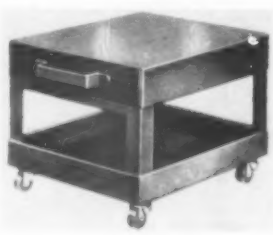


The Number Tells the Age

Of considerable interest to "Gadgeteers" and inventors in general is a pocket sized folder, issued by Invention, Inc., by which the age of any patent issued up to 1946 can be immediately ascertained. Titled "Telling the Age of a U. S. Patent by its Number," the folder contains a dated tabulation of the numbers for patents, reissues, designs and trade-marks for 110 years—or from 1836 to 1946. The folder is free, and may be had by writing Invention, Inc., Munsey Bldg., Washington 4, D. C.

Handy Andy Scooter

A newly designed 4-wheel mechanic's scooter, named the "Handy Andy Scooter," has recently been introduced by H. D. Campbell Company of Rochelle, Ill. The unit, which is of steel and finished in metallic gray, is particularly useful in home workshops, garages, libraries, schools, factories—in fact, any place where work confines one to kneeling or bending as, for example, in offices for filing. Dimensions are 11" high, 10" wide and 12" long; weight, 10 lbs. Provided with a convenient shelf and a top drawer for the storing of small accessories.



Drilling and Boring Tools

Installment No. 8 of a Series

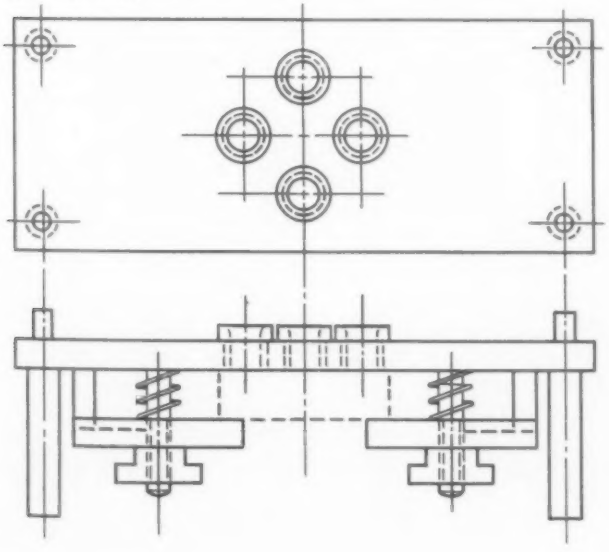
CONTINUING ON DRILL JIG construction, we will confine this installment to simpler elements. Fig. 1, below, shows a Leg Type Template Jig for turn-over. This construction permits drilling from one side and reaming, counterboring or tapping when turned over. Locating stops for the part are not shown, the idea being to show principles of construction and use, rather than details.

While this type of jig is rather inexpensive to construct, it is quite accurate because the bushings are close to the workpiece. Intended primarily for small parts and small quantity production, it has the advantage of light weight, easy loading, and unloading (note the slide-back clamps). It can be advantageously used on gang drills, for successive operations as stated above, but not to advantage on multi-spindle drills. This is because drill pressure is against the clamps, which confines it to comparatively small drills, one hole at a time.

Fig. 2, at lower right, shows a Lid Type Template Jig for drilling on one side only. This construction is suited to heavier work and, since the drill pressure is against a solid support, it can be used on multi-spindle drills. Like the leg type jig in Fig. 1, this jig is quite accurate and comparatively inexpensive. Since clamping by the lid alone (say with spring jacks) is not entirely satisfactory, hand knobs may be used provided they do not interfere with the drills. It shares both the advantages and disadvantages of the leg type template.

In Fig. 3, upper right, we have a Ledge Type Jig for front loading. Like the jig described above, this tool is inexpensively constructed, and is especially suited for drilling long plates or bars with a number of holes spaced at regular or irregular distances. It can be clamped to the drill press table, and is well suited to multiple large lot drilling.

FIG. 1, below. Leg type template turn-over jig. *FIG. 2,* at right, lid type template jig.



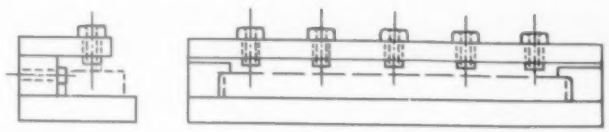
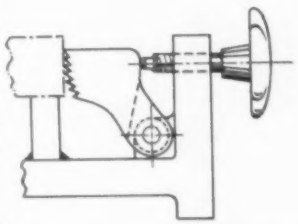


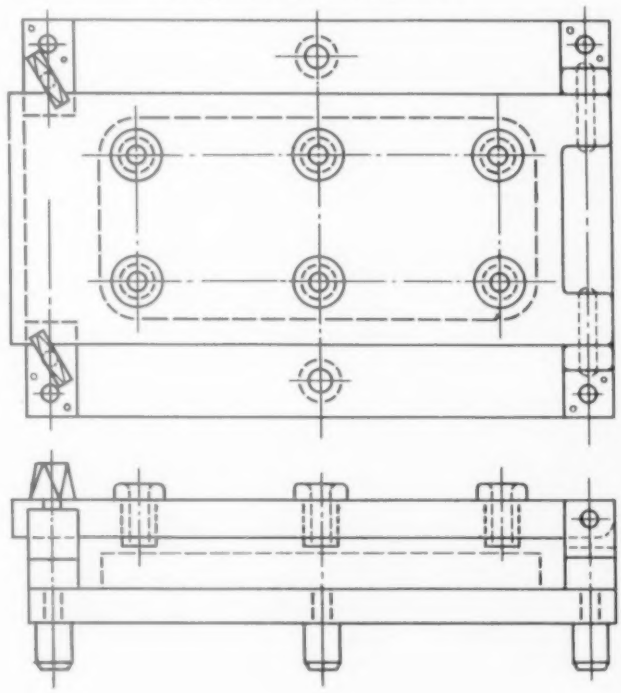
FIG. 3, above. Ledge type jig. *FIG. 4,* at right, serrated jaw retracting clamp.



No clamping is shown; however, the end and back stops locate the work and, when used under a multi-spindle head, the several drills neutralize "walk" of the workpiece while the drills are starting in. If, however, clamping should be required, one could use swing type clamps, with hand knobs, which would swing clear for front loading. Because the drills can run in the bushings, when the head is up, and therefore close to the work, there is little "cutting of wind," and the jig can be advantageously used with an air motor which, to all practical purpose, provides automatic cycle drilling.

Fig. 4 shows a type of serrated jaw clamp, actuated by a hand knob. While not shown, a spring should be included to retract the jaw. The advantage of a clamp of this type is that swing is on a descending arc, forcing the workpieces back against the far stop as well as downward against the

Figs. 1, 2, 3, 6, 7 and 8 by courtesy of International Business Machines Corporation, Endicott, N. Y.



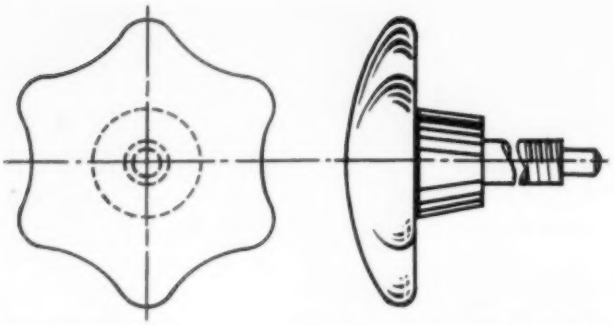


FIG. 5. Typical hand knob.

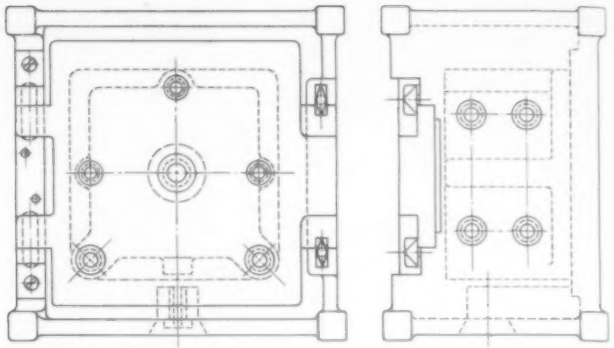


FIG. 7, at right. Heavy box type jig.

bottom support. Note the angles of the serrations, the tops being approximately radial with the pressure point and the angular sides at an approximate 45 degree down-angle. When so angled, the tendency is to maintain the "in-and-down" pressure in the event that the jaws should creep in, as a result of chatter or vibration when drilling.

Fig. 5 shows a typical hand knob. In this connection, it is recommended that hand knobs be as large as possible, consistent with size of work and fixture used. The head should preferably be an oval shape, for comfortable hand grip. There has been considerable opposition on the part of some designers, in the past, to the use of large hand knobs, it having been contended that operators would twist off the screw; however, this contention is cancelled by the facts. Small hand knobs, requiring considerable exertion to tighten, are conducive to fatigue; hence, operators are tempted to use wrenches which are much more likely to break screws.

A simple turn screw, serving the same purpose as a hand knob, is made by drilling the head of a square head set screw and inserting a pin. For that matter, the pin can be welded on. It will be found, however, that the pinned screws tend to tire the hands, and the operator will resort to a wrench. Since the use of the latter is time consuming, as well as conducive to breakage, it is better to provide adequate hand knobs in the first place.

In Fig. 8, we show a means of construction rather than a type of jig—which, incidentally, is box type, 4-way tumble. Here, however, we have a deep box section entailing extreme accuracy between the base plate and the stud which locates the part. The stud must be at exactly right angles in relation to the base. Because of the deep section, it would be rather difficult to accurately machine the inside of the base plate; hence, the box is a separate casting, dowelled and bolted to the base.

That way, the base may be bored and the face and legs accurately faced—as in a lathe—and either ground or scraped to true angularity. The base, which is of semi-steel (as is the body) serves as the bushing plate. This construction is a typical example of the economics that can be effected, along with enhanced accuracy, by making a jig in several parts instead of one piece.

A certain disadvantage, in the construction shown, is that drill thrust is exerted against the one central nut, the whole tending to put considerable strain against the stud which, while not so shown, is held in place with screws through the flange. To obviate this, the box could be opened, both ends, and two retractable clamps used in place of the clamp nut. The jig would still tumble, for loading and drilling the flange and cross holes as indicated in the part.

Another cast semi-steel Box Type Jig is shown in Fig. 7. This type is designed for parts where quality and accuracy must be maintained regardless of tool cost. However, one advantage of box jigs is that they accommodate parts of irregular shapes; also, they can be set in a cradle if so desired for drilling holes at angles with the sides. Another advantage is that the majority of the holes—especially the important ones—can usually be bored at the one setting.

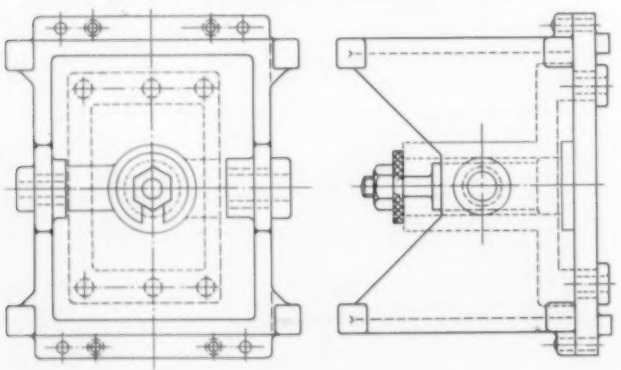
The disadvantage, in mass production drilling, is that they are usually heavy and may require auxiliary hoists or other means for turning them over. When so turned, they must be pulled clear of the drill spindles. They may, however, be trunnioned, when suitable locking devices may be required. As a general rule, they are hard to load and unload, and to clean; hence they are not recommended for long run high production work.

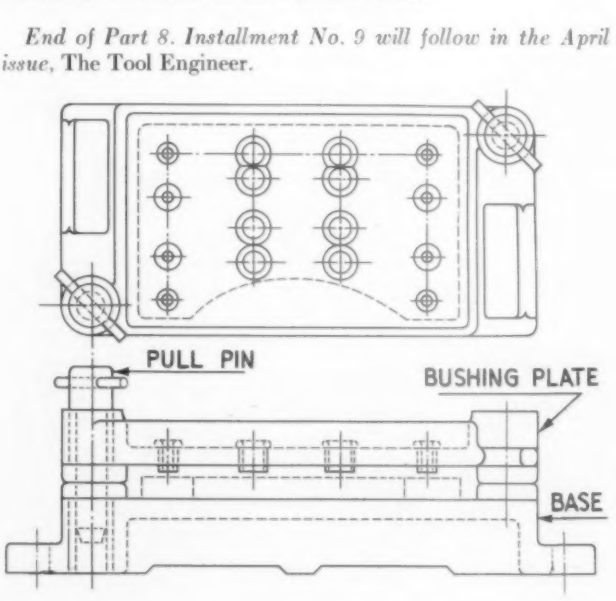
Fig. 8 shows a drill jig for use with several multi-spindle machines set side by side. The fixture moves on a carriage (it could be moved on rollers by making the bottom line solid) and, for each change of holes, the bushing plate is interchanged. With this type, up to 144 holes may be drilled in a group of 6 machines having 24 spindles each. This fixture, however, is introductory to multiple drilling techniques which will be discussed later in this series.

End of Part 8. Installment No. 9 will follow in the April issue, The Tool Engineer.

FIG. 6, below, showing method of constructing 2-piece box jig.

FIG. 8, at right, special jig for station to station multi-drilling.





21 Technical Speakers Will Participate in Houston Program

Many Fields to be Explored at Houston Meeting

WITH ANNOUNCEMENT of a number of additional speakers, fuller details and further revisions in the setup, the complete technical program for the ASTE Annual Meeting at the Rice Hotel in Houston, March 19-22, now lists presentations of 21 experts in various fields.

Supporting F. J. Tone, Jr., Vice-President and General Manager of The Carborundum Co., at the Wednesday afternoon Crush and Diamond Dressing session will be Boyd H. Work, Manager, Abrasive Engineering, Product Development Div., and D. H. Currie, Abrasive Engineer of the same company.

Will Review Abrasives

Mr. Tone's keynote address on "The History, Development and Progress of the Abrasive Industry" will embrace the background of the industry from the creation of the first manufactured abrasive to the present; details of recent developments, improvements and applications of modern grinding wheels, including such important factors as abrasive grain types, wheel structures, bonds and wheel gradings; and an informative introduction to the subject of crush wheel and diamond dressing to be discussed by Messrs. Work and Currie.

In "Crush Diamond Dressing as Related to Thread Grinding," E. V. Flanders, Chief Engineer, Thread Grinding Div., Jones & Lamson Machine Co., will attempt to point the way to the most effective use of each of the two recognized means now being employed to form wheels for thread grinding. Description of tests and records of actual experience will be included. Emphasis will be on production.

W. C. Lockwood, Engineer Specialist, Technical and Research Div., The Texas Co., will assist A. A. Nichoson, Assistant to Vice-President, in the Thursday morning presentation, "The Tool Engineer Looks at Oil." Considered an expert on all phases of cutter grinding, Mr. Lockwood has devoted his efforts to the problem of cutting oils for more than a decade.

The showing of two films, "Deep Horizons" and "Masters of Molecules," will be a part of this program.

The afternoon symposium, "Magnesium and Plastics Fabrication," will be in two parts with a question and answer period following the presentation of each of the two themes.

N. D. Griswold, Assistant General Manager of the Texas Div., The Dow Chemical Co., will speak briefly on both plastics and magnesium before introducing Gordon B. Thayer, Engineer in Charge of Molding Service, Plastics Div.; C. E. Lehnhardt, Chief Engineer, Magnesium Fabrication Div.; and Arthur M. Lennie, Sales Engineer, Magnesium Div.

Plastics Authority

Mr. Thayer, author of the book, "Plastics Molds," and a contributing editor on *Industrial Plastics* magazine, has worked with Dow for six years on plastics machine design and material development. His subject will be "Plastics Materials and Fabricating Methods." Mr. Lehnhardt will speak on "Fabricating Magnesium," discussing such manufacturing processes as forming, deep drawing, welding, riveting and spinning, with emphasis on tooling requirements for these processes. With Dow since 1934, he pioneered the use of magnesium in the transportation field, later aiding in the development of methods for fabricating magnesium.

"The Machining of Magnesium," Mr. Lennie's topic, will include proper tools and techniques, comparison with the machining of other metals, proper safety procedures and other pertinent material. He is a member of ASTE, ASM, ASME, and NFPA.

Two lectures, "What Industry Expects in the Development of Tool Engineers," by W. D. Merrifield, Assistant to Director of Industrial Education, Chrysler Corp., and, "What Education Can Do in the Development of Tool Engineers," by Dr. W. R. Woolrich, Dean of Engineering, University of Texas, and the subsequent open discussion will occupy the entire evening meeting, "The Professional Approach to Tool Engineering," according to the realigned schedule.

Friday morning keynoter, introducing "Specialized Precision Instruments," will be Dr. R. R. Morse, Director of Exploration East of the Rockies, Shell Oil Co., Inc. A former professor of geology, Dr. Morse is the author of many technical articles. A Shell color-sound film, "Prospecting for Petroleum," will also be shown on this program.

J. H. Dunaway, Sr. Research Physicist of the Humble Oil & Refining Co., will follow Dr. Morse with a paper on the "Manufacture and Use of Geophysical Instruments." Why skilled workers, ranging from watchmakers to blacksmiths and welders, and equipment as diversified as jewelers' tools and 100-ton plastic molding presses are required for making geophysical instruments will be revealed by Mr. Dunaway.

Both the reflection seismograph and the gravity meter, widely used in prospecting for oil, must be mechanically designed with delicate sensitivity to precisely record subterranean conditions, but with ruggedness to withstand transportation by truck, marsh buggy, boat or on a man's back, and the ill effects of humid climates and variable temperatures.

Precision Without Special Tooling

Tooling methods will be described and illustrated, together with means of attaining high accuracy in limited runs at an economical cost without special tooling. Parts and processes will be shown. In addition, Mr. Dunaway will explain, with the aid of slides, basic geophysical methods of prospecting and the organization of a geophysical department.

Col. Willard F. Rockwell, President of Rockwell Manufacturing Co., sponsor of the Friday afternoon discussion of special valve and meter manufacture, has named

A. E. McIntyre

W. D. Merrifield

◆ To Speak ◆

J. H. Dunaway

C. E. Lehnhardt

B. H. Work

R. R. Morse

W. L. Kennicott

D. H. Currie

A. M. Lennie

G. B. Thayer

A. E. McIntyre, General Manager of the Pittsburgh Equitable Meter Div. and Nordstrom Valve Div., to present the tool engineering phase of the subject.

Mr. McIntyre will show where the tool engineer fits into the valve and meter business; where he encounters "thin ice"; why there should be cooperation between accounting and tool engineering; specific tooling problems in valve manufacture; ingenuity as a tool engineer's stock in trade; and the difference in tool engineers' approach to the manufacture of valves and of meters.

Col. Rockwell will introduce the afternoon topic with an address, "The Tool Engineer's Place in the World."

All other speakers are scheduled as reported in the February issue of *The Tool Engineer*.

* * *

During the Texas meeting, announcement will be made of the James F. Lincoln Arc Welding Foundation award for the outstanding contribution to *The Tool Engineer* on the subject of arc welding. A specially designed ASTE medal is to be struck for the award. A lead model of the medal to be awarded for the first time in 1948 will be shown by the Honor Awards Committee.

Pittsburgh Wins Trophy

Another feature will be the annual presentation of the Society's Membership Trophy. Winner for 1946 is Pittsburgh Chapter who topped all others with a score of 2897.655 out of a possible 3000 points. Runners-up are Milwaukee with 2886.526 and Cleveland with 2884.320.

Enthusiasm for ASTE's first National gathering in the Southwest is running high, not only with the membership, but in the host city itself. Among civic representatives and other prominent citizens who will welcome the Society to Houston are Mayor Oscar Holcomb and Jesse Jones, former head of the U. S. Commerce Dept. and RFC.

Groups from all parts of the country and Canada will arrive by plane, train and private automobile. Many are planning family vacation itineraries around their convention trips.

Excellence of the program, the pent-up desire for interchange of new technical knowledge, intensified by cancellation of the fall meeting at Pittsburgh through strike conditions in that city; opportunity for extensive travel, and the mild climate of the meeting city are expected to attract one of the largest attendances in recent years.

Take Your Camera To Houston

Your best shots of ASTE convention scenes may make the Member Pictorial Page in the May issue. Pictures used will be credited. Photographs must be fully identified and must reach *The Tool Engineer* not later than April 4. Send prints to: ASTE News Editor, The Tool Engineer, 1922 W. Canfield, Detroit 8, Mich.

◆ To Serve ◆

Hoyt Turner

A. F. Miller, Jr.

L. M. Krause

H. G. Boswell

In addition to the 17 Host Chapter Committeemen shown in the February issue, Houston members serving on convention committees include: L. M. Krause, Executive; Hoyt Turner, Chairman, Plant Visitation; H. G. Boswell, Budget; and A. F. Miller, Jr., Notices and Announcements. Photographs of the four committeemen were received too late for publication in last month's convention section.

John C. Preston, the Chapter Chairman, heads the Executive Committee.

Vehicles Now Equipped With Mobile Phones

Grand Rapids, Mich.—Mobile radiotelephone service was explained by Neil C. Youngs of Detroit, Sales Supervisor for the Michigan Bell Telephone Co., to approximately 40 members and guests of Western Michigan Chapter at a recent dinner meeting in the Rowe Hotel.

Mr. Youngs described the new communication service, which will be available to Grand Rapids later this year, and its use in automobiles, boats and airplanes.

He detailed how calls are put through and received from any other instrument in the nation's telephone system; named advantages, limitations and costs of the service, now in operation in Detroit and other cities.

At the close of the meeting a telephone equipped automobile was inspected by the audience.

A color-sound film of wild life in the United States was shown prior to Mr. Youngs' address.

Must Speak Softly; Carry Big Stick

Detroit, Mich. — America must take the lead to prevent World War III, with a sound, just plan for all nations and a determination to carry it through both diplomatically and with force if necessary, declared Dr. Walter Johnson, well-known University of Chicago Roundtable commentator and featured speaker at the January 9 meeting of Detroit Chapter.

No such concrete plan, continued Dr. Johnson, has been produced in the first year and a half of peace. Indecision and reversal of procedure will give no better results than the peace plans following the first world war. Every nation's problems are our problems, regardless of size, form of government, race or religious belief.

Control of America's wealth and industry is the ultimate goal of every warring nation, he added. In the last two wars, attempts to eliminate our allies first, so that we would stand alone, have failed, but the enemy will not make the same mistake a third time.

Other vital topics of the day were also discussed by Dr. Johnson.

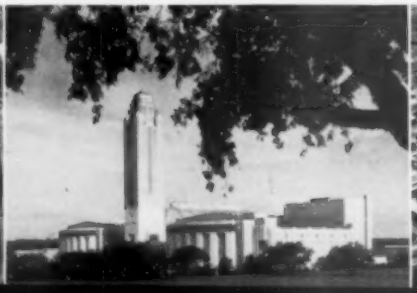
Two nominating committees were elected, one to nominate Chapter Officers, and another to choose candidates for Delegate and Alternate. W. M. McClellan, Grant Wilcox and Clyde Hause were named to the former committee, with William Moreland, T. B. Bellamy and Mr. Hause elected to serve in the latter capacity.

Other News In This Issue

Chapter	Page
Chicago	52
Fond du Lac	53
Hamilton	49
Louisville	53
New Haven	53
Peoria	49
Pittsburgh	51
Portland (Me.)	50
(Providence) Little Rhody	51
Rochester	50
Rockford	54
(St. Charles) Fox River Valley	53
St. Louis	51
Toledo	52, 54
Toronto	51
(Washington, D. C.) Potomac	50, 54
Williamsport	49
(York) Central Pennsylvania	51
Coming Meetings	54
Situations Wanted	49

To Hang Out Latchstring ◆ ◆ ◆ ◆

A stopover at Dallas and Fort Worth, home of North Texas Chapter, makes a pleasant break in the trip to the Houston convention. Ladies will most certainly want to shop in Dallas, fashion center of the Southwest. Shown here, from left: Skyline and Cotton Bowl at Dallas; Will Rogers Memorial Coliseum, Auditorium and Convention Hall where Southwestern Exposition and Fat Stock Show is now in progress at Fort Worth, seen from the air at right



Dr. Donald A. Laird, eminent psychologist, emphasizes his six-point formula for getting along with people, during his address, "Human Relations and the Technique of Handling People," before Peoria Chapter. Looking on is C. A. Woodley, Technical Chairman for the recent dinner meeting

Laird Urges Heart-Power In Human Relations

Peoria, Ill. — The secret of getting along with people was divulged to an overflow crowd of 375 persons attending the joint dinner meeting of Peoria Chapters, ASTE and ASM, January 14, at Hotel Pere Marquette, by a modern medicine man who offers a panacea for mental worries instead of for physical ailments.

His six-point formula is: Ask questions (but intelligent ones), be brief, have a confident manner, use directness, be earnest, and be friendly.

Speaking on "Human Relations and the Technique of Handling People," Dr. Donald A. Laird, psychologist, author and lecturer, urged his audience to remember one prime rule, "Put heart-power in your human relations. When handling yourself, use your head; when handling others, use your heart."

Ask Intelligent Questions

On the first point, "Ask questions," the practical psychologist who self-styles himself, "Dr. Whiskers," revealed that a well-timed intelligent question may sometimes be the turning point in your relationship with another person.

"Sure, our impulse is to 'tell 'em,' but we learn more by asking. I know a man who asks his employees' advice on matters of importance, not because he wants the advice, but simply to boost their ego.

"Another employer asks an irritated worker to repeat his complaint. When you have to repeat a gripe, the second time it takes the shrillness out of your voice and the bitterness out of your argument."

An after dinner story goes over with this group at Hamilton Chapter's meeting in the Royal Hotel, Guelph. At the speakers' table, from the right, are: John Ball, Secretary; R. K. Dawson and Walter Brydges, Guelph; W. A. Dawson, Natl. Asst. Secy-Treas.; J. N. Walton, Chairman; Don Thorburn, guest speaker; G. E. Robertson and W. C. Woods, Guelph; W. A. Alexander, 1st V.-Chm'n; and Gordon Hall, 2nd V.-Chm'n

Dr. Laird warned, however, "Never ask a customer 'Well, what do you think of it?' Instead, ask him the magical sales question, 'What do you like *best* about it?' From that point on, he's selling himself."

Even if you have to bluff it out, you have to have a confident manner in life. In fact, according to the speaker, the only way to acquire a confident manner is to pretend you're confident until you really are.

"Walk as if you meant it! Throw away those rubber heels and composition soles that turn you into a cat!" he admonished.

Be Sincere

If you want to get on in life, you should, following Dr. Laird's magic formula, also look the other fellow straight in the eye when talking to him, have a handshake which gives YOU confidence as well as the other fellow, be nice to people no matter how they look, make a profit, but make a friend when you make that profit, be sold on your job yourself, and convey your earnestness to other people.

Echoing Marley's bitter words to Scrooge, "Business! Mankind was my business!" Dr. Laird concluded, "Sure, be all business, but don't forget, the most important part of your business lies in human relations. Give friendliness, and don't hesitate, give your friendship first."

Dr. Laird served for 20 years as a psychology instructor at Colgate, Iowa State, Northwestern, Wyoming and Yale universities.

Situations Wanted

LAYOUT AND CHECKING on special machinery and tools. Twenty-five years' experience includes trouble shooting and some supervision. Detroit area location preferred. Write Box 111, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

TOOL AND GAGE DESIGNER, age 28, with 5 years' experience, seeks permanent connection with small midwestern firm. Will accept position anywhere in continental U. S., if housing conditions permit. Can qualify as tool inspector. References and qualifications in first letter. Senior Member, ASTE. Address replies to Box 110, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Russia's Low Wages Peril Export Trade

Hamilton, Ont.—The low wages of 50-70 cents a day paid Russian workers will make it hard to compete against them, warned His Worship Gordon L. Rife, Mayor of Guelph, the Royal City of Canada, as he urged Hamilton Chapter members to "design tools so Canada can compete with other countries." The Mayor was speaking before a dinner meeting of Hamilton Chapter held recently in the Royal Hotel at Guelph.

If the Russian standard of living is not brought up to ours, the only answer is greater production and better quality, the Mayor added, cautioning "These countries will get on their feet again and when they do they will certainly try for the markets."

Don Thorburn, Manager, Brantford Engineering & Equipment Co., Brantford, delivered the technical address of the evening. Interest in his subject, "Fundamentals Governing Selection of Furnaces and Fuels," was manifested in the subsequent question period.

Entertainment and group singing were enjoyed by the gathering.

Head table guests included a number of Guelph industrialists. The meeting was attended by 115 engineers from the surrounding area.

Light Waves Measure With True Accuracy

Williamsport, Pa. — Adam Gabriel, Vice-President, Acme Industrial Co., Chicago, Ill., discussed "Light Waves and Their Use in Precision Shop Measurements" before 56 members and guests of Williamsport Chapter at a recent dinner meeting in the Home Dairy.

Adam Gabriel

Mr. Gabriel's lecture was well illustrated with slides showing the extreme accuracy obtainable in measuring surfaces with light waves.

J. L. Strasburg, Chairman, opened the business meeting which preceded the technical session, with an introduction of guests. Out-of-town visitors included E. C. Smuts of Pittsburgh Chapter.

Details Engineering Program Essential to Defense

Washington, D. C.—Three engineering projects are vital for national defense, if we must keep this country in a state of preparedness, despite our aversion to war: 1. Improvement of existing weapons; 2. Clarification of ordnance drafting practice; and 3. Retention of scientists for ordnance research.

By 1945, weapons considered good in 1941 were known to be only the first stage in the very advanced armament practicable and necessary, if we are ever again to face the misfortunes of war, P. H. Girouard, Chief Engineer of the Navy Department Bureau of Ordnance, declared while addressing the recent fourth annual Executive Night of Potomac Chapter.

To Standardize Drafting

Standardization of drafting practice in ordnance activities, continued the speaker, is underway to make it conform more nearly with drafting in major American industries; to provide for more well-designed commercial items in ordnance equipment, and to keep ordnance production requirements abreast with up-to-date methods, for greater coordination and economy.

In commenting on the need for outstanding scientists in ordnance research and development, Mr. Girouard pointed out that the swifter torpedoes of the future will be fitted with electronic and acoustic brains. Rockets will be similarly equipped for use as guided missiles. Much more will be expected of radar and fuzes than at present, and guns must shoot projectiles faster and at much higher velocity.

While scientists will play leading parts in the development of these new defense weapons, they have little interest in the engineering problems involved in obtaining easy production and satisfactory maintenance and performance of this equipment. Engineers and scientists must work together more closely for the maximum in national defense at minimum cost to the people.

Germans Underrated Our Technology

Earlier in his address Mr. Girouard related some of the engineering problems incident to the production of naval ordnance for World War II. He gave a comparison of German and American equipment, based on his observations abroad. The Germans' smugness in their scientific, engineering and productive ability blinded them to our superior resources in these fields, he said.

Notwithstanding the haste with which our war materiel was developed, it was the finest in the world and a credit to every engineer connected with its production, the speaker added. Even the terrific strain of atomic bomb tests showed that most ordnance units had been designed with considerable ruggedness.

Honor guests at the dinner meeting in the Mayflower Hotel were: W. C. Vose, Captain, USN, and Commanding Officer, U. S. Naval Torpedo Station; C. E. Margerum, Head Engineer, Materials Section, and H. L. Boesch, Head Engineer, Bureau of Ordnance, Navy Dept.; H. N. Schofield, Principal Ordnance Engineer, Naval Gun Factory; A. Wilbur Mace, District Manager, Allegheny-Ludlum Steel Corp.; and W. Daryl Winger, Chairman, Baltimore Chapter, ASTE.

To commemorate Portland Chapter's fifth anniversary, E. R. Andrews, a Past Chairman, presents a bronze bell to the Maine Tool Engineers. From Mr. Andrews' left are: Lee H. DeWald of M.I.T., technical speaker; Merton C. Corson, Chapter Chairman; his father Harry A. Corson, who presented a gavel; and, in the rear, Carl Bohlin, First Vice-Chairman. Right: Closeup of bell with Society emblem, and plastic-headed gavel

P. H. Girouard, Chief Engineer of the Navy Dept. Bureau of Ordnance, tells Potomac Chapter members science and engineering must cooperate for better ordnance at lower cost. At right is E. M. Seifert, former ASTE Director and toastmaster for the Annual Executive Night at which Mr. Girouard was principal speaker

Sees Bright Prospects In Economic Picture

Rochester, N. Y.—Likening the postwar political and economic chaos to the storm-tossed surface of a great ocean, John C. Howell, economist and lecturer, stressed the orderly methods under the familiar law of supply and demand by which the situation will be resolved, while addressing a joint dinner meeting of Rochester Chapter, ASTE, and the Superintendents and Production Managers Group of the Industrial Management Council, Rochester Chamber of Commerce. The recent meeting was held in the building of the latter organization. Mr. Howell's subject was "The Case for Prosperity."

As storms subside, said Mr. Howell, so do the difficulties with which we are beset, and again we sail under fair trade winds which steadily blow our individual ships onward to their appointed goals in safe harbors and the consummation of our desires.

Conflicting Economic Forces

The speaker detailed some of the forces interfering with the fundamental law of supply and demand, such as "talk of a depression," inflation, labor unrest, attempt to incorrectly control prices, warlike condition of the world and others. He set forth a basis for prosperity in favorable conditions for raw materials, transportation, consumer goods, creation of new wealth, advanced standard of living all over the world and the creation of abundant purchasing power.

Mr. Howell then dealt with things that bear directly on the tool engineer, showing that his work is a vital factor in bringing about good business conditions in this country and abroad. He believes that we have only about two years to prepare for the greatest era of competition that the world has ever known, that we should plan and act accordingly.

Approximately 200 members and guests of both organizations were present. Charles Seely, Chairman of the ASTE Chapter, presided and introduced the speaker.

Cutting Tool Advances Shown by Metallurgist

Portland, Me.—Guest speaker at the recent fifth anniversary meeting of Portland Chapter was Lee H. DeWald of the Metallurgical Dept., Massachusetts Institute of Technology, Cambridge, Mass.

Mr. DeWald's subject, "Carbides, Proper Selection and Applications," was illustrated with slides. Describing iron base cutting tools from infancy to the present day carbide tools, the speaker showed their comparative hardness, chemical content and proper uses.

A feature of the anniversary meeting was the presentation of a bronze bell and gavel to the Chapter. The bell was presented by the Hyde Windlass Co. of Bath, through Edwin R. Andrews, Treasurer and General Manager of the company and a Past Chapter Chairman.

Harry A. Corson, a tool salesman and father of Merton C. Corson, Chapter Chairman, presented the gavel.

Among out-of-town guests attending the meeting in the Graymore Hotel were: Thomas W. Wallace, a banker from Sanford; H. A. Bullard of Alfred; Albert T. Smith of Cambridge, Mass.; John L. Morosini of Stuart Oil Co., Boston; and Donald Lang of Mississippi Shipping Co. Also present were 15 representatives of Hyde Windlass Co.

Shows Multitude of Parts Made of Powdered Metal

St. Louis, Mo. — Approximately 150 members and guests of St. Louis Chapter heard Douglas B. Martin, Sales Manager, Amplex Div., Chrysler Corp., Detroit, Mich., give an exceptionally fine talk on Powder Metallurgy as the technical feature of a recent meeting at Hotel Melbourne.

D. B. Martin

W. G. Ehrhardt

Mr. Martin supplemented his lecture with numerous slides, illustrating the manufacture of parts from powdered metal. A table in the front of the room was literally covered with fine examples of this work. After the talk, a large portion of the audience gathered around the table to receive from the speaker first hand information on their problems.

Announcement was made that Willis G. Ehrhardt, a Past Chairman of the Chapter and candidate for ASTE National Director, had been elected President of the National Tool and Die Manufacturers Association.

A minute of silence was observed for the late Carl Werscheid while his obituary was read by William G. Callies, Editorial Chairman.

Costs Reduced By Broaching

York, Pa.—Ernest A. Isberg, formerly Division Staff Supervisor of Tool Engineering in the Aviation Gas Turbine Division of Westinghouse Electric Corp., Lester, Pa., was principal speaker at the technical session following a recent dinner meeting of Central Pennsylvania Chapter, in the West York Inn.

E. A. Isberg

More than 50 members and guests heard Mr. Isberg emphasize that, with ever increasing costs, management's only salvation is to employ improved and more efficient methods which the tool engineer will be expected to explore and apply.

Through a series of slides and films, the group was shown many interesting high and low production broaching applications, resulting in cost reductions over and above conventional machining operations. Included in these were a number of close tolerance and intricate form applications, such as small quantity of broaching blade roots in jet propulsion rotors. Other applications shown in the automotive field involved mass production runs.

The entire program depicted the flexibility possible in the use of both horizontal and vertical type broaching machines. A question and answer period closed the meeting.

Diamond Compounds Improve Superfinish

Pittsburgh, Pa.—Claimed as the newest and most extensive improvement in superfinishing is the diamond microfinishing process described in detail by R. D. Karnell, Manager of the Industrial Processing Div. of Magnus Chemical Co., Garwood, N. J., before 100 members and guests of Pittsburgh Chapter at a dinner meeting December 6 in the Fort Pitt Hotel.

The Magnus system of micro-finishing, Mr. Karnell stated, is based on four major improvements, each vitally important in the end results made possible through compounds developed by the company.

1. Precision-graded diamond abrasives made from carefully selected high-grade whole virgin bort, thus producing powders that are pure and of uniform particle sizes ranging from 120 microns to 1 micron (U. S. Bureau of Standard Ratings).

2. Pre-mixing eliminates the wasteful and often unsatisfactory blending of diamond powders by the user, giving a properly proportioned compound that saves time, eliminates spilling, contamination and errors in grit selection.

3. Preparation in both tube and stick form offers a selection of eight separate gradings or particle sizes in either type. In the former, the compound is a paste dispensed from an eyetip collapsible tube, permitting the exact amount to be exuded for any given finishing job, or for charging a lap. The stick form is more viscous, having about the consistency of lipstick. This proves highly satisfactory in many types of production work, because of the ease and speed in smearing or applying to a small lap.

4. Elimination of guesswork and error, in quickly selecting proper grit sizes in correct sequence to obtain any desired finish, is assured by distinctive color identification of each grade.

Intense interest in Mr. Karnell's subject was evidenced by the lively question and answer period following his talk.

Industry Will Extend Research, Says Bourne

Toronto, Ont.—"Today's trend is towards greatly expanded industrial research," emphasized G. E. Bourne, speaking before 150 members and friends of Toronto Chapter at a meeting, December 9, in Malloney's Art Gallery.

Mr. Bourne, highly conversant with his subject, "Some Fruits of Industrial Research," is Manager of the Special Products Section, Canadian General Electric Co., Ltd.

Illustrating his talk with slides, he discussed some interesting developments applicable to the industrial field. Measurement of surface finish, a machine to register and "fix" color designs for the textile industry, and another to gage the speed of a projectile have come about through research in electronics.

Industrial plants, the speaker declared, now show much more interest in research, because the war proved its value.

A question and answer period followed and Mr. Bourne displayed many electronic tubes, from 6" water-cooled to small sizes no thicker than a pencil.

A Norton sound film, "Lessons in Grinding," demonstrated that grinding is without hazards, if correct procedure is followed. But, a grinding wheel which has been dropped or roughly handled becomes a potential threat to the operator and should be returned to the factory for safety tests, as slight cracks, invisible on the surface, may be present.

First Vice-Chairman L. M. Jardine presided over the meeting in Chairman Walter Appleton's absence from the city.

Annual Fun Nite

Providence, R. I.—Little Rhody Chapter held its Annual Christmas Party, December 18, at Oates Tavern, with 120 members and guests present for the dinner and entertainment program.

An assortment of attractive gifts, donated by Chapter members, was distributed to the gathering. The affair concluded with vocal selections rendered by many of the members.

Display of powdered metal parts shown by D. B. Martin of Amplex Div., Chrysler Corp., holds interest of St. Louis members after his talk on this subject. Gathered around end of table are: E. Stackel, Service Eng. of B. C. MacDonald & Co., local Amplex agent; L. L. Thill, Asst. Prod. Mgr., Lewis Invisible Stitch Machine Co.; Ernst Leidecker, Toolmaker, Ritepoint Co.; and William R. Duncan, Lewis Tool & Die Foreman

Goofy Gadget Inventor Highlights Chicago Fun-Nite

"Prof." Russell I. Oakes, "the Wizard of Waukesha," demonstrated his hilarious inventions, "postwar products with a punch," for Chicago Chapter's Fun-Nite, January 6, at the Graemere Hotel. Left: Charming strolling accordionists help pass the time for the hungry tool engineers lined up for the buffet supper table (center). Right: The "Professor" displays one of his contraptions to Chairman Clare Bryan and the audience of more than 350

Tool Standardization Assignments To Be Reviewed

Detroit, Mich. — In order to more nearly balance committees as to users and buyers, Chapter assignments on the formulation of 20 major standards for small tools, machines and accessories will be re-studied, according to a decision reached at a recent meeting of the ASTE National Standards Committee.

A complete reassignment of Chapter standards activities will be necessary to effect the revision of the Project No. 5 setup.

It is the plan of the National Standards Committee to establish projects clearly defined as to scope, to determine whether they overlap current ASA programs.

As projects are announced in *The Tool Engineer*, volunteers will be invited to serve on the various committees. On the basis of applications received, the members best qualified will be appointed project chairmen.

In line with the cooperative standardization activities of the two societies, it is expected that ASA will appoint such chairmen to their technical committees already functioning on the respective assignments. Where no ASA committee exists for a specific project, ASTE, through ASA, will sponsor such a group.

Another undertaking, interrupted by military production activities, will be resumed with the reactivation of the ASTE-sponsored ASA Committee B.52 for Classification of Materials for Tools, Fixtures and Gages, the ASTE National Standards Committee has announced.

Society representatives serving on ASA committees are being surveyed to determine whether they wish to continue or would recommend successors.

Slides and Samples Show Surface Finishes, Methods

Toledo, Ohio—Technical program for one of Toledo Chapter's recent meetings was sponsored by the Norton Co., with Dr. Lowell H. Milligan, Assistant Director of Research, and Herbert S. Indge, Lapping Development Engineer, presenting "Surface Finishes and How to Obtain Them."

Dr. Milligan discussed finishing methods, results and measuring of surface finishes, using slides to show highly magnified pictures of the various finishes.

Mr. Indge lectured on the practical problems involved in securing very fine finishes by lapping. With slides he showed machines and fixtures for several applications, also exhibiting samples of work finished by this method.

As an added feature, the film, "Precision With Norton Abrasives," was shown.

Where the Money Comes From . . . Where It Goes

Many of our members wonder, no doubt, *where the money comes from* to operate the American Society of Tool Engineers and its diversified projects . . . and, more pertinent and important, *where it goes.*

Like every efficiently operated corporation, the National Officers and Board of Directors of the Society are now giving a detailed report of income and expenditures to the Society's stockholders, which are the individual members. Since the shares are held equally by these members, the breakdown below has been made of a per member basis.

In looking over these detailed figures, it will be interesting to note that although the Society's dues per member are only $10 per year (the average dues are actually $8.98 per member, owing to lower dues rates for Student and Junior Members), the American Society of Tool Engineers shows an income of $42.21 per member. The difference between the dues and actual income is made up through revenue from expositions, donations, earnings of *The Tool Engineer* and other sources shown in the following report.

It is equally interesting to note that for the dues of $10 (or less in the case of Student and Junior Members), each member receives benefits from the Society totaling $32.78.

The answers to these and many other pertinent questions regarding your Society's income and expenditures are answered in the following statement:

Number of Members		As of September 30, 1946	
Honorary		2	
Life		14	
Senior		13,252	
Junior		2,329	
Affiliate		9	
Associate		154	
Student		17	
Armed Service		1,022	
Total			16,799
Income from Dues			
Dues	$119,298.26		
T.E. Subscriptions	31,599.80		
Total		$150,898.06	
Income from Publications and Services		258,759.42	
Income from New Era Exposition		274,972.10	
Donated by Nat'l Officers		1,425.08	
Misc. Income		23,083.57	
Total Income			$709,138.23
Income per Member			
Average Dues Income per Member		8.9826	
Average Income per Member from Publications and Services		15.4033	
Average Income per Member from New Era Exposition		16.3683	
Average Income per Member Donated		.0848	
Average Income per Member—Misc.		1.3741	
Total Average Income per Member			42.2131

Expense per Member	
Committees	
Constitution and By-Laws	.2392
Editorial and Directory	.8292
Educational	.0954
Finance	.0304
Handbook	1.1941
Honor Awards	-0-
Judicial	.0003
Membership	.2205
Nominating	.0653
Program	.2290
Public Relations	.1674
Standards	.5218
Other Operations	
National Office	4.7580
Meetings—Annual and Semi-Annual	.8014
New Era Exposition	6.8142
Travel—Director and Nat'l Officer	.2389
Tool Engineer	14.4195
Returned to Chapters (Allocations)	2.1554
Total Average Cost per Member	32.7800

Top, left to right: Past Chairmen Charles Billberg, Arthur F. Schroeder, William Felten and Gideon Kane are honor guests at a recent dinner meeting of Fond du Lac Chapter. Below: Speakers' table group, left to right: Henry Faith, Second Vice-Chairman; V. E. Miles of U. S. Broach Co.; J. P. Schommer, First Vice-Chairman; R. L. Kamischke of U. S. Broach Co.; L. J. Kaufman, Chapter Chairman; E. F. Graf of U. S. Broach Co. (technical speaker); and Fred H. Kessenich, Chairman of Madison Chapter. Right: Part of the group of 71 members and guests gathered at Hotel Athearn in Oshkosh

Unmachineable Alloys Cast by Lost Wax Method

St. Charles, Ill. — Fred R. Venton, Service Engineer of Haynes Stellite Co., spoke before Fox River Valley Chapter at a meeting held December 3 in Hotel Baker.

His talk, illustrated by slides, concerned uses of the investment casting or lost wax method as applied to precision casting of machine parts which would ordinarily be too intricate to machine economically. By this method, cobalt, chromium, and tungsten alloys in their various modifications are used to produce corrosion, abrasion and heat resistant parts, otherwise unmachineable.

Used in Jewelry and Dentistry

Outstanding is its application in the manufacture of turbo-supercharger buckets and gas turbine vanes. Prior to its use in engineering, the investment casting method was most commonly utilized in technical dentistry and jewelry manufacturing.

Mr. Venton described the various steps in producing a casting. From the blueprint of the part to be manufactured, a master pattern is made in brass, steel or other durable material, depending upon the design of the part. This pattern, Mr. Venton said, is 1.5 per cent oversize to allow for both wax and metal shrinkage.

Soft tin-bismuth injection dies are then prepared from the master pattern. As many wax patterns as are required to produce an order are made by forcing hot wax into the injection dies. These wax patterns are then assembled to gates and risers by "wax welding" and mounted on wax hubs molded especially for the purpose.

Silica-Coated Patterns Processed

The final molds are then prepared by dipping the wax patterns into a very fine silica suspended in a suitable medium, which is then screened with a coarser material on the fine silica coating and the assemblies dried in a conveyorized oven. After drying, the assemblies are placed in cylindrical flasks which are then filled with ceramic investment material.

The molds which have been allowed to age for several hours are loaded upside down in a continuous furnace having a temperature ranging from 1300° to 1900° F., depending on the heat being produced and the wax melted out.

Meanwhile raw materials for the alloy to be cast are accurately weighed out, melted down and cast into small "stick" pigs. In filling a mold, just enough pigs are melted, in a small indirect arc furnace, to fill one mold. When the metal has reached the correct temperature, the hot baked mold is inverted directly over the pouring spout of the furnace and clamped in place.

The metal is poured by inverting the entire furnace and mold. A three-pound air pressure is applied from an air line connected to the furnace. This air pressure makes possible the casting of dense structures and filling in of thin edges.

Removed with Pneumatic Hammer

After cooling for about four hours, the entire casting assembly is knocked from the mold by means of a pneumatic hammer and excess investment material is removed. Gates and risers are removed, the castings shot blasted, surface irregularities ground smooth, and the lot presented for inspection.

Inspection consists of visual and dimensional checking followed by zyglo tests for surface cracks, and X-ray examinations to reveal possible internal flaws that would make the part unsuitable for use.

Following the lecture, Mr. Venton displayed a number of parts which had been made by the "lost wax" process. These included blades used in an axial flow compressor for a jet engine, a spray nozzle and a sewing machine feed dog, as well as other intricate parts.

Golden Rule Successful In Business and Industry

Louisville, Ky.—"The Golden Rule in business and industry is practicable," declared Harry Coopland, Special Representative for Jack & Heintz, Inc., Cleveland, Ohio, addressing the 85 members and guests attending the Annual Ladies Night of Louisville Chapter, held in the Kentucky Hotel, December 10.

Harry Coopland

Mr. Coopland's talk, "Seeing Is Believing," was presented in an arresting and entertaining manner. He cited many applications of the Golden Rule at the Jack & Heintz plants.

Ray Doninger, Second Vice-Chairman, projected a technicolor sound film released by the Libby-Owens Co. and showing the manufacture and use of glass containers for canning vegetables. The picture interested the members, as well as their feminine guests.

Another feature which delighted the ladies was the distribution of prizes consisting chiefly of aluminum kitchenware and household articles. Past Chairman Charles H. Peters was in charge of the drawing for the awards.

High Professional Plane Urged by Winter

New Haven, Conn.—Otto W. Winter, ASTE National Education Chairman, gave the principal address at New Haven Chapter's Christmas party in the New Haven Country Club at Whitneyville. His subject was "Professional Aspects of Tool Engineering."

Significance of the tool engineer in war and peace and opportunities in the future were detailed by the speaker, who described activities now under way to secure proper recognition for the profession.

Many technical schools and colleges, realizing the need for this specialized field, are setting up training programs. New text books to aid tool engineers are being sponsored by the Society.

Dr. Bethel, Director of the YMCA Junior College, preceded Mr. Winter with a brief talk concerning changes being made in engineering courses at his school, where special emphasis is being placed on tool design. He expressed interest in a Chapter award now under consideration for presentation to a student in the tool engineering group.

Following the speaking program, entertainment was provided and gifts and door prizes distributed among the approximately 100 in attendance.

Former Chairmen Feted

Fond du Lac, Wis. — Past Chairmen and Officers of Fond du Lac Chapter were honored at a recent dinner meeting in the Hotel Athearn, Oshkosh, by 71 members and guests from communities in the Chapter area.

Honor guests attending the dinner meeting were: Arthur F. Schroeder, William Felten, Gideon Kane and Charles Billberg who acted as master of ceremonies. Two other former Chairmen, William Rutz and Keith F. Gallimore, were unable to be present.

Each of the previous Chapter heads related amusing incidents of his term in office and made recommendations based on his own experiences.

The technical program, "Broaches and Broaching Tools," was presented by E. F. Graf of the U. S. Broach Co. After his introductory remarks concerning advantages of broaching in both large and small lots and methods of estimating costs, Mr. Graf showed films on broaching practice.

The speaker was accompanied by R. L. Kamischke and V. E. Miles, also of his company.

Another motion picture of pheasant hunting in South Dakota completed the program.

Coming MEETINGS

ALL CHAPTERS—March. Installation of officers.

CINCINNATI—April 8, 6:30 P.M., Cincinnati Engineering Society. Speaker: L. R. Twyman, Mgr., Ind. Div., Vickers, Inc., Detroit, Mich. Subject: "Hydraulics."

CLEVELAND — March 14. Plant tour through White Motor Co., preceded by dinner at the plant and a talk by a company official. April 11, Allerton Hotel. Speaker: L. S. Bergen, Pres., Bergen Precision Casting, Inc., Pleasantville, N. Y. Subject: "Precision Casting."

COLUMBUS—March 12, 6:45 P.M., Fort Hayes Hotel. Speaker: Gordon Rideout, Norton Co., Worcester, Mass. Subject: "The New Non-Crushed Abrasive and Its Meaning to Industry."

DETROIT—March 13. Industrial Executives Night. Speaker: Guy Hubbard, Machine Tool Editor, *Steel*, Cleveland, Ohio. An address on the history of the machine tool industry. March 25. Speaker: Prof. O. W. Boston, U. of Mich., Ann Arbor, Mich. Subject: "Problems Associated with Metal Cutting, Cutting Tools, Material Cut, Cutting Fluids."

ELMIRA — April 7, 7:00 P.M., Mark Twain Hotel. Program to be presented by Education Committee.

FLINT—March 20. Subject: "Cutting Oils and Drawing Compounds." April 17. Trip through Universal Engineering Co., Frankenmuth, Mich.

HAMILTON — March 14, 7:00 P.M., Fischer's Hotel. Speaker: A. E. R. Turner, V.-Pres. in Charge of Sales, John Bertram Co., Ltd., Dundas, Ont. Subject: "Machine Tools of Today." April 11, Galt. Speaker: L. G. Elder, Chief Spring Eng., Wallace Barnes Co. Subject: "Mechanical Springs."

HOUSTON — March 19-22, Rice Hotel, 15th Annual Meeting, ASTE. March 20, House of Delegates Meeting. March 20-21, Board of Directors Meeting.

LITTLE RHODY — March 19, Oates Tavern. Speaker: R. E. Hamilton. Aluminum Session. April 16. Speaker: P. D. Smith. Subject: "Jet Propulsion Turbines."

MILWAUKEE—March 13. Speaker from Haynes-Stellite Co., Chicago, Ill. Subject: "Selection of Hard-Facing Materials and Methods." April 10. Subject: "Uses and Abuses of Twist Drills," sponsored by Cleveland Twist Drill Co.

PHILADELPHIA—March 20. "Quiz Masters" and "Doctor I.Q."

SYRACUSE—April 15, 8:00 P.M., Onondaga Hotel. Speaker: Waldemar Naujoks, Chief Field Eng., The Steel Improvement & Forge Co., Cleveland, Ohio. Subject: "Production Forgings and Their Relation to the Tool Engineer."

TOLEDO—March 12. Dinner, 7:00 P.M., Commodore Perry Hotel. Speaker to be announced. April 9, 7:00 P.M., Toledo Yacht Club. Program to be sponsored by Doehler-Jarvis Co.

TORONTO—April 11, Ladies Night, Royal York Hotel; Dinner and Dance. April 14. Speaker: Howard Mills, Bellows Senacon Co., Akron, Ohio.

Casting Design Problems Influence Quality, Cost

Rockford, Ill.—Rockford Chapter observed its Annual Past Chairman's Night with a dinner at the Masonic Cathedral, January 9.

Before the technical session, Harry Conrad, ASTE Executive Secretary from the Detroit office, was introduced by George C. Johnson, National Secretary of the Society, who presided at the meeting. Mr. Conrad spoke briefly, stressing the importance of active Chapter participation in National as well as local Society affairs. He concluded his talk by announcing plans for the Annual Meeting at Houston, Texas.

L. E. Everett, Vice-President in Charge of Surveys for Lester B. Knight & Associates, Chicago, gave a technical address on "Casting Design in Relation to Quality and Cost."

Mr. Everett, using slide illustrations, showed that casting design must be economically as well as technically correct. He explained some of the design problems in steel and gray iron castings, such as "rangeness," isolated heavy sections and section junctions and their influence on quality and cost.

Past Chairmen who planned and attended the meeting were Edward W. Dickett, Kenneth W. Lund, Henry Ruehl, Fred J. Kampmeier, Leo Reuland, Fred Swanson, Walter Lustig and Mr. Johnson.

Toledo Chapter officers entertain representatives of Textileather Corp. at their table during dinner preceding January meeting in the Toledo Yacht Club. Left to right: Lawrence Rothert, Secretary; Albert Hage, First Vice-Chairman; J. S. Mather, Assistant to G. H. McGreevy, Sales Manager of the Textileather Coated Fabrics Div.; Mr. McGreevy, guest speaker; Richard M. Hindman, Chairman; and Russell H. Brown, Treas.

Straight Line Flow Speeds Coated Fabric Making

Toledo, Ohio—An example of almost perfect straight line production, as illustrated in the manufacture of coated fabrics, was brought to Toledo Chapter members by G. H. McGreevy, Vice-President in Charge of Sales, Textileather Corp., Toledo.

Mr. McGreevy, speaking on "The Importance of Coated Fabrics in Industry," at a meeting January 8 in the Toledo Yacht Club, stated: "We start with one or two basic raw materials for each product and, through repeated manipulation, end up with a finished product of extreme versatility and application."

Processing of the cotton or other type fabric and manufacture of unsupported plastic films is a special order business in yardage varying in width from 30" to 120".

180 Million Combinations

Great variety is possible in the almost unlimited number of combinations of color, grain and quality. For instance, Pyroxylin coated Textileather is produced in 216 standard qualities, available in 3100 different color formulae and a choice of 266 embossing patterns—totalling almost 180 million possible descriptions.

End use raises another complication as the same quality, color and grain description may be produced for each of five different purposes—luggage, bookbinding, upholstery, baby carriage material and bindings.

"Each production run," said Mr. McGreevy, "must be formulated to meet the end use requirements of the particular industry to which that material is going. Luggage material requires a hard, dry abrasion resistant surface with little requirement for flexing. Bookbinding material requires good surface abrasion resistance and fair flexing resistance. Upholstery must have excellent flex, and fold resistance and good surface abrasion."

Referring to the many conventional and unusual applications of coated fabrics, processed fabrics, leather cloth, and flexible plastic films, Mr. McGreevy cited 16 major industries making 92 specific end uses of his company's products.

In his opening remarks, Mr. McGreevy reviewed the history of the coated fabric industry and its many applications in various types of equipage for the armed services.

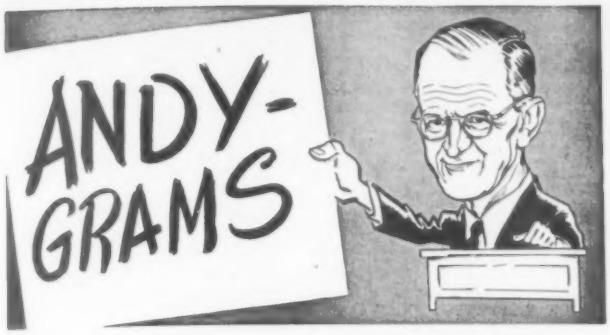
The program was of especial interest to the local members, 100 or more of whom visited the Textileather plant last November.

Tells New Developments In Screw Machining

Washington, D. C. — An outstanding technical session was recently presented by Potomac Chapter at the Pepco Auditorium, before a group of 75 members and guests.

Speaker for the evening was Harold Berry, Production Engineer at the Naval Gun Factory, and an authority on automatic screw machine methods. His talk dealt with the latest developments in various types of automatic screw machines and what may be accomplished in holding of tolerances.

Following the lecture, a sound film was shown through the courtesy of Ampco Metals, Inc.



A NEW LIGHT has been thrown on a dark subject by Shrdlu of "Steel," who comments editorially on the international problem created by the Young Writers Club (?) of Lagos, Nigeria. Never could make up my mind, personally, whether those avid collectors of "catalogs" were budding literati or just plain fuzzy-wuzzies. Either way, they've put Nigeria on the map, (ask Anton Peck of L.A.; he knows) from which one may suspect that they're inspired by a master publicity mind. But, as for importing 'em, as Shrdlu suggests, we've still plenty of local color to draw on.

Speaking of Shrdlu reminds me that, wherever I've worked, I've pulled at least one major or minor boner to mar an otherwise fair to middlin' record. Fortunately, the most were caught before any harm was done, although one of 'em cost Al Sargent 80 bucks back in '34. And that's the only thing I hold agin' Al—that he wouldn't let me pay for it.

But coming up to date, we've had quite a call for reprints on the Gear Symposium published some time back, and we stored the page forms hoping for a chance to get at the job. T'other day, the boys down in the composing room wanted to kill a lot of lead that's been accumulating, so I gave 'em the green light. Then, feeling my oats, I took one of the madeup pages and heaved it ceilingward. Crash!—type all over the place! Then, one look, and I nearly went through the floor myself. I'd completely pied the one page, on the Symposium, that hadn't been put away! As I've said before, I have to learn the hard way.

LAST CALL FOR HOUSTON

From one thing to another, I want you boys to slant the announcement of the A.S.T.E. "A Suggested Unit Course in Jig and Fixture Design," on the *Good Reading* page, this issue. My heartiest congratulations to the boys who compiled this work which, to put it mildly, is a masterpiece—about the best so far produced.

Easily the Alpha to Omega in tool design courses, this work will be an inspiration alike to cub draftsmen and veteran tool engineers, to students and erudite professors in leading technical institutes. It is the *Esperanto* of tool engineering, and will appeal to our friends in Latin America, England, Scandinavia and everywhere that men try to create a better design for living. So, get in your order!—this work is *recommended*.

I also want to refer you to "The Case for Fundamentals," by E. H. Wheeler, this issue. Originally, this article came in as a letter to the editors, but the letter was so thought-provoking that we asked permission to publish it as an article. As for the criticisms referred to, about the *Fundamentals of Tool Engineering*, these have been so few that they've been exceptions to the rule. As a matter of fact, this feature of *The Tool Engineer* has become so popular that, eventually, we'll have to publish it in book form.

Like many another guy with good intentions, I've been trying to wean myself of cigarettes, and maybe I'll make the grade, now that Jimmy Giern, of the Giern & Anholtt Tool Company, presented me with one of his *engineered* pipes. Quite a gadget, in which you can smoke your mix drip or regular grind without juicing up. Nice, cool smoke, 'n' dry as a bone—nary a bite nohow! Incidentally, the G & A partners started a shop, out Romeo (Mich.) way, where they're making 'em, and whither confirmed pipe smokers may now wear a path as wide as the trail that led to the famed maker of better mousetraps. Thanks, Jimmy!—for the first time, I like a pipe.

Speaking of Romeo, I was invited out there, t'other day, to speak to the local Rotarians. Friendlier gang 'o' men you'll never meet, the ASTEers not excepted. Fred Hebert, of hydraulic renown, introduced me as one of those speakers who are either good, bad or indifferent. Since I was all three, that saved my face—all but a jumping toothache. However, the local boys, including the parson, shook hands with me and made me feel right at home in spite of my shortcomings.

The meeting over, Fred took me out to his new plant, housed in a triple Quonset hut. Don't look too big from the outside, those huts, but once inside you'd think you were in the Cleveland Auditorium. Oodles o' room! Anyway, Fred's got quite a plant, where he's busy turning out new hydraulic equipment. And, I take it, he's happy in a small town, with its friendly neighborliness.

OIL'S WELL DOWN IN HOUSTON

Succumbing to high pressure on the part of Jno. (short (?) for John) Cannon, I sat for a pic t'other day, and now I've come to realize that movie actors earn their salt. Those d—d lights! First they blind you, and then they make you sweat until you feel all scatchy in your flannels. Bet I'll look worse'n the sourpuss Mother Nature turned out in an off moment. Anyway, here's hoping for a pleasant surprise, like out-glamouring Clark Gable—or should I have said Ray Morris?

Among other things, was quite impressed by an exchange of letters between Grant S. Wilcox, Jr., and the editors of Webster's Dictionary. Seems that, during an informal discussion anent the definition of a tool engineer, at one of the St'ds Com'tee meetings, Grant had put the case so well that the boys had suggested its inclusion in Webster's. At any rate, the lexicographers showed themselves to be quite impressed by Grant's definition—which, incidentally, was well considered and very scholarly—so, it won't be surprising if, before long, tool engineering becomes officially included in our vocabulary. Nice work, Grant!

HOW ABOUT RETURNING VIA NEW ORLEANS?

Indicative of the way members and readers feel, about *The Tool Engineer*, is a letter from Windsor Chapter, A.S.T.E., addressed: to Society H.Q., attention of A. M. Sargent, Prex, as follows:

Gentlemen:

The Executives of this Chapter, at a recent meeting, discussed at some length *The Tool Engineer*.

We want to take this opportunity of congratulating you and all the men responsible for the producing of such a fine technical publication. We also find it exceptionally interesting in regards to the Chapters' activities and the one hundred and one interesting items that are displayed and so amply described in our own language.

We want to wish you continued success and to advise you that if there is any way in which we can possibly help, that we are behind you 100%.

Yours very respectfully,
Windsor Chapter, A.S.T.E.
K. J. Libby, Secretary.

Well now, that's right nice of our friends across the Border, but then, the Canadians have a habit of saying nice things—and doing 'em as well. The Maple Leaf and the Lone Star ought to go well together down in Houston.

ASTEely Yours,

Andy

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

Tru-Lay Push-Pull Controls, a catalogue by **AUTOMOTIVE & AIRCRAFT DIV'N,** American Chain & Cable Co., Inc., 6-235 Gen'l Motors Bldg., Detroit, tells how this control transmits back-and-forth action through a flexible metal conduit, and also how the product is made; lists assemblies, kinds of heads and fittings; and includes drawings of a great number of applications.

HUNTER ELECTRO-COPYIST, INC., Syracuse, N. Y., has published *Reproduction Papers for the Hunter Electro-Copyist*, a 34-page catalogue showing their line of reproduction papers and other materials for use by business offices and engineering departments.

SURFACE COMBUSTION CORP'N, Toledo 1, Ohio, has two new bulletins available for distribution: *No. SC-132*, describing "Surface" prepared atmosphere roller hearth furnaces for ferrous and non-ferrous bars, tube and strip; and *Bulletin No. SC-131*, giving certain basic facts on hardening with "Surface" combustion standard rated furnaces.

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, announces *Bulletin No. 204*, setting forth the convenience of operation and setup, and outstanding performance characteristics of their improved line of flash welding machines.

REYNOLDS METALS CO., Dept. 47, 2500 S. Third St., Louisville 1, Ky., has two interesting reference books available: *Reynolds Aluminum Alloys & Mill Products*—a 248-page data book on the history, chemical and physical properties of aluminum—also including a comprehensive listing of Reynolds' aluminum alloy and aluminum mill products; as well as a great amount of other pertinent information. Priced at $2.00 per copy. The other book, *Heat Treating Aluminum Alloys*, a 144-page compilation on the metallurgy and heat treatment of the aluminum alloys, is written for the non-technical reader, as well as for the highly trained technician and other operating personnel. Copies available at $1.00 each.

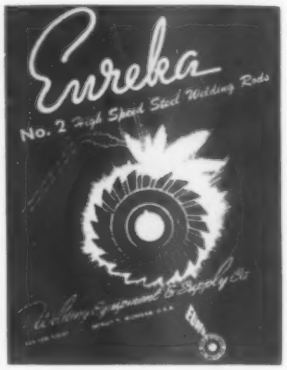
ISLAND EQUIPMENT CORP'N, 101 Park Ave., N. Y. 17, has released *Bulletin PF-8*, featuring their combination conveyor and mechanized worktable, called "Unitable," for assembly, inspection and packing operations.

VAN NORMAN CO., Springfield 7, Mass., has a new bulletin, *No. 22L & 22M Ram Type Milling Machines*, presenting advantages of the adjustable cutter head, movable ram, and other operational features of these two new machines.

LIPE-ROLLWAY CORP'N, Syracuse 1, N. Y., has two interesting folders available: *Lipe Pneumatic-Automatic Bar Feed*, and *Lipe Pneumatic Bar Feed for Multiple Spindle Automatics*.

NORTON COMPANY, Worcester 6, Mass., has a new folder, *Norton Cylindrical Grinders*, picturing their 4", 6", 10", 14" and 16" Type C Grinders, all especially designed for high precision on a high production basis.

WELDING EQUIPMENT & SUPPLY CO., 223 Leib St., Detroit 7, announces a new and attractive 6-page folder, *Eureka No. 2 High Speed Steel Welding Rods*, wherein welding procedures are explained for the use of these well-known rods, in repairing high speed steel cutting tools; for compositely fabricating cutting tools; as well as for creating cutting, wearing and bearing surfaces.



AGET-DETROIT CO., Ann Arbor, Michigan, has available *Bulletin No. 392*, explaining how their dust collectors—one placed at each machine—effectively eliminate dust and lint from polishing and buffing operations.

GREEN, TWEED & CO., North Wales, Pa., has just compiled *Catalog No. PC-100*, as a convenient guide to their "simple, yet complete" Palmetto line of mechanical packings.

BOTWINIK BROTHERS OF MASS., INC., New Machine Tool Div'n, 2 Sherman St., Worcester 1, Mass., has a new *Bulletin 8*, one of a series, listing electrical tools, grinders, lathes and metal cutting band saws now available for immediate delivery from Worcester stocks.

VAN KEUREN CO., 176 Waltham St., Watertown, Mass., has published the following printed forms, now available at five cents per copy: *VK-101*, Wire Measurement of Standard Spur Gear; *VK-102*, Wire Measurement of Spur Gear, Enlarged Pinion or Reduced Gear; *VK-103*, Wire Measurement of Standard Helical Gear; *VK-104*, Zahorski Method for Measuring Standard Helical Gear; and *VK-105*, Zahorski Method for Measuring Enlarged or Reduced Helical Gear.

EX-CELL-O CORP'N, Detroit 6, has a new *Bulletin 11882-B*, explaining sizes under A.S.A. standards and prices on drill jig bushings.

CAPEWELL MFG CO., 60 Governor St., Hartford 2, Conn., has issued a circular, *No. 1640D*, describing the Capewell line of Precision Ground Flat Stock.

SHELL OIL CO., INC., 50 W. 50th St., N. Y. 20, has issued a 14-page booklet, *Steel Mill Lubrication*, dealing with centralized lubrication systems as applied to blooming mill operation.

MODERN COLLET & MACHINE CO., Ecorse, Mich., lists its complete line in *Catalog 47*, describing such products as collets for all screw machines, lathes and milling machines; pushers of all types; alloy steel screw machine cams; screw machine replacement parts; gears; and details of their screw machine rebuilding service. Price lists are also included.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

PERHAPS ONE OF THE MOST comprehensive works ever offered to the tool engineering profession is **JIG AND FIXTURE DESIGN,** a collaboration by the *New York State Vocational and Practical Arts Association* and the *American Society of Tool Engineers.* Volume 1—"A Suggested Unit Course in Jig and Fixture Design," now at press and soon available, has been jointly developed by the two associations.

The text material has been prepared by a committee of trade and technical teachers in cooperation with practical and experienced Tool Engineers from Rochester (N.Y.) industries; and, dealing as it does with important aspects of elementary design, it also describes a great number of the techniques employed by Tool Engineers for the mass production of manufactured products.

While primarily intended for those beginners who have a reasonable skill in mechanical drawing and an understanding of machine tools and processes, it is nevertheless an invaluable "tool" for the veteran Tool Engineer as well. However, basic emphasis is laid on the necessity of the student exercising and developing ingenuity and inventiveness; and, through design and assignments, the student is also provided with ample opportunity to develop designs and to work out practical problems.

Volume 1, 339 pages, consists of an extensive outline of tool design principles and practices. Among topics discussed are: Introduction to Tool Design; Function of Jigs and Fixtures; Jig and Fixture Design; How Designs of Jigs and Fixtures are Planned, and Tool Drawings. Following this outline, there are five complete units of instruction which deal with the design of one or more types of jigs and fixtures. Each unit is made up of three main sections, for each tool to be designed. These are:

1. Basic Principles—an illustrated outline and a discussion of the principles of design involved in a particular type of jig or fixture.

2. Demonstration—a description of the tools required for the production of a given part. An illustrated and detailed explanation of how certain basic principles of design are applied to a tooling problem.

3. Assignment in Design, which deals with design of special tools for the production of a similar part to that described in the demonstration section. A brief outline of directions, hints and suggestions is given to help and guide the student.

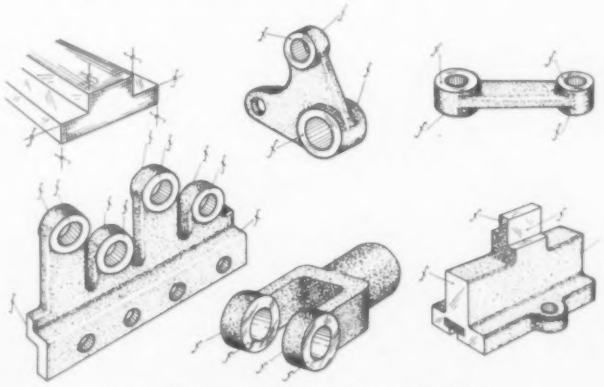


FIG. 5 PARTS REQUIRING STRADDLE MILLING OPERATIONS

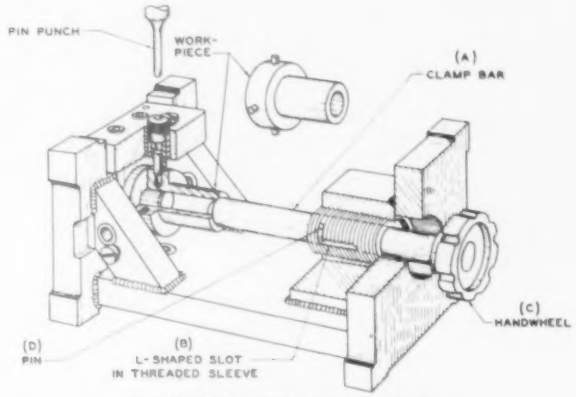


FIG. 7 COMBINATION DRILL AND ASSEMBLY JIG

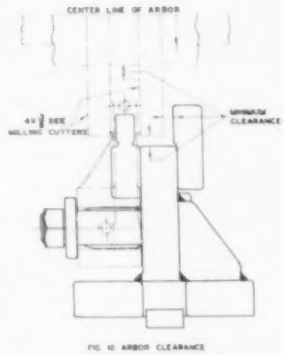


FIG. 10 ARBOR CLEARANCE

The types of tools discussed, range from simple drill templates to combination drill and assembly jigs, from milling machine vise jaws to highly refined milling fixtures — all clearly and profusely illustrated. In addition, the monograph has six appendices which give a wealth of supplementary information, and is supplemented by a packet folder containing twelve parts' drawings, thirteen production plans and twenty-two tool drawings, all explained in the text. The course, of which several typical illustrations are reproduced, is suitable for trade schools, technical institutes and engineering colleges teaching tool design.

The text has been reviewed by Otto W. Winter, Nat'l Ch'man, A.S.T.E. Educational Com'tee, who says in gist:

"The American Society of Tool Engineers wishes to recommend . . . this important work. There is a distinct . . . need for practical . . . tool design teaching material . . . that can be effectively absorbed by the aspiring student. This volume, the first step of a series in that direction, covers the elementary phases of jig and fixture design."

Obtainable, at $7.50, from the *American Society of Tool Engineers,* 1666 Penobscot Bldg., Detroit 26, Michigan.

JIGS AND FIXTURES FOR MASS PRODUCTION, is a new book written by Leland A. Bryant and Thomas A. Dickinson. As the title implies, the text deals with tools that are collectively known as "jigs and fixtures"; but, the whole is actually a comprehensive treatise covering such subjects as plastics, hydraulics and pneumatics as applied to tooling.

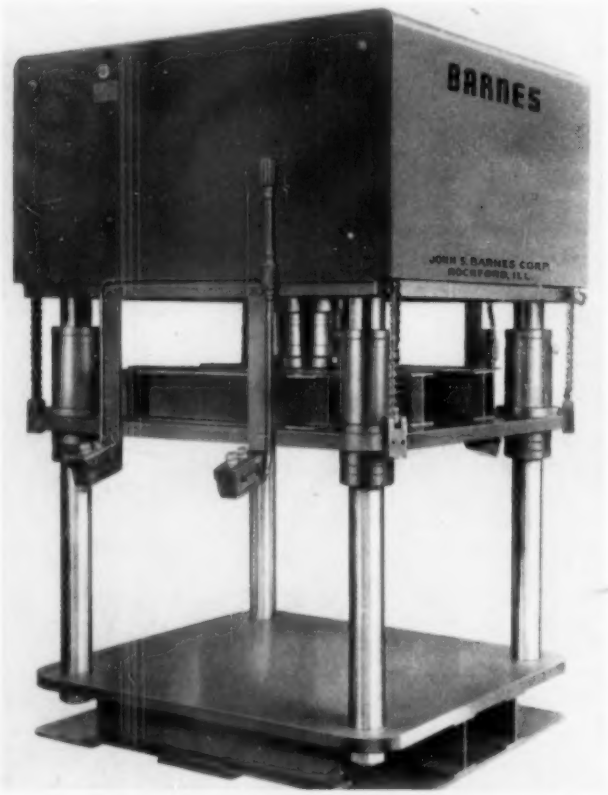
Simply written and well illustrated, the subject material includes most of the wartime developments, including the Master Tooling Dock, the latter an invention of co-author Bryant, who is Chief Tool Engineer for the Aircraft Engineering Company. Mr. Dickinson, who is consulting engineer with Calresin Corp'n, is known to *The Tool Engineer* readers for his articles on plastic developments and tooling. The book is published by the *Pitman Publishing Corporation,* New York, N. Y., and retails for $3.50 per copy.

TOOLS OF TODAY

New Hydraulic Presses

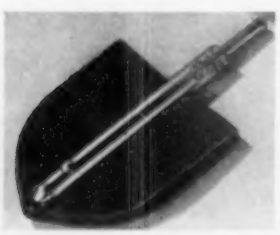
INGENIOUSLY COMBINING the functions of several machines into one compact unit, two new **HYDRAULIC PRESSES,** by the *John S. Barnes Corp'n*, Rockford, Ill., are said to mark distinct advances in the high speed handling of sheet metal fabrication. Ruggedly constructed for severe service, and powered by Barnes self-contained Hydraulic Units for smooth operation, these presses—of 25 and 50 ton capacities—are designed for punching, piercing, forming and drawing operations.

As typical of economies effected, complete operations may be performed at one setting, with only one or two operators, with production costs sharply reduced as a result of combining multiple operations. Because of the greater accuracy of new operating methods, production rate is increased, rejects are reduced and "down" time sharply cut. Dual electrical controls insure safe and flexible operation.



New Abrading Pads

DESIGNED TO CLEAN or polish metal or other materials, and for deburring and chamfering among many other uses, the **RB ABRADING PADS** come from ½" x 2" to 9" x 10", in four standard shapes and in grits from 24 to 320. The pads may be operated in any lathe, drill press, flexible shaft or other driver. The *Wilkinson Equip't Co.*, 109 E. 69th St., Chicago 37, have been appointed sales distributors.



New Broach Sharpener

DESIGNED IN LINE with the modern theory that increased productivity can be obtained only if the job is made easier for the operator, a new **BROACH SHARPENING MACHINE**—the FS3-36 by *Colonial Broach Company*, Box 37, Harper Station, Detroit 13, makes it possible for tool grinders to sharpen flat surface broaches, even several feet long, while comfortably seated and relaxed.

To permit the operator to sit comfortably close to the machine, the base is built up out of three pedestals. Two of these support the table at either side, forming a deep knee-hole at the back of which is the third pedestal supporting the grinder head.

Two hand-wheels, for controlling lengthwise movement of the table and for raising and lowering the grinder head are located at the right side of the knee-hole, for easy reach, rather than in the center of the machine.

The main operating control is the "lazy-reach" lever, with which the grinding wheel is moved back and forth across the face of the broach teeth to sharpen them. This lever is mounted on the front of the machine, is adjustable up and down, in and out, and radially so that the tool grinder can set it to what is, to him, the most comfortable operating position. To further ease the operation, the cross-slide carrying the grinder head is of lightweight construction and is mounted on ball bearings at both top and bottom. With this construction, all sliding friction is virtually eliminated.

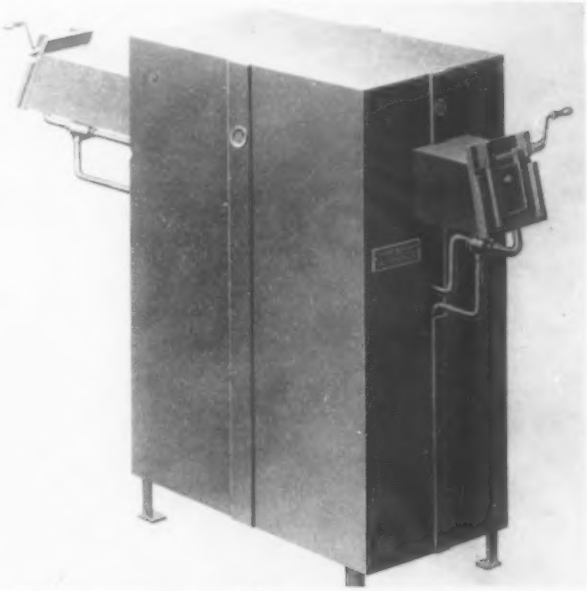
Self-Sealing Test Plugs

A NEW PRODUCT, known as a "Hydro-Matic" Self-Sealing **TEST PLUG,** for use in closing openings in tanks, boilers or other vessels requiring hydrostatic or pneumatic internal pressure tests, is announced by *Mechanical Products Corporation*, 168 N. Ogden Ave., Chicago 7.

These test plugs, which are now available from stock for standard pipe openings from ½" to 2" sizes provide a speedy and effective means for sealing tank openings, particularly against high pressures.

New G-E Box Furnace

A NEW **BOX FURNACE,** designed to meet modern laboratory requirements for high, automatically-controlled temperatures, is announced by the *Industrial Heating Division* of the General Electric Company. Suitable for operation up to 3100° F., the new furnace can be used in such applications as melting and bright annealing of metals, sintering of powdered metals, reduction of metallic oxides, ceramic firing, and copper and silver alloy brazing of metals.



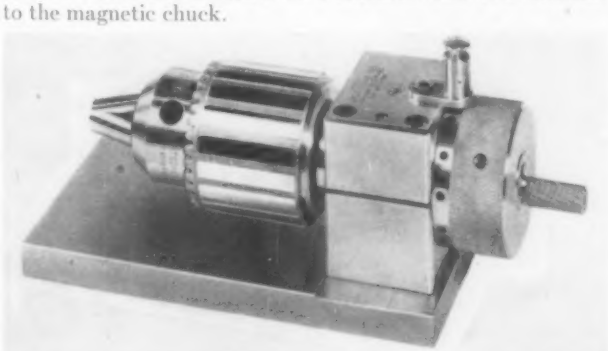
The heating units (molybdenum rods formed into sinuous loops and supported inside the heating chamber) are rated 20 kw, 65 volts single phase at 3100° F. The heating chamber, 4 in. wide, 4½ in. high, and 25 in. long, is lined with refractory brick backed by heat insulation, and the top of the chamber is removable for inspection and servicing.

A cooling chamber permits materials to be cooled in a protective atmosphere, preventing oxidation of the charge. This water-jacketed chamber is separated from the heating chamber by a manually-operated sliding door. The doors of the heating and cooling chambers are provided with manually-operated flame curtains to prevent loss of atmosphere when open.

Rotary Grinding Attachment

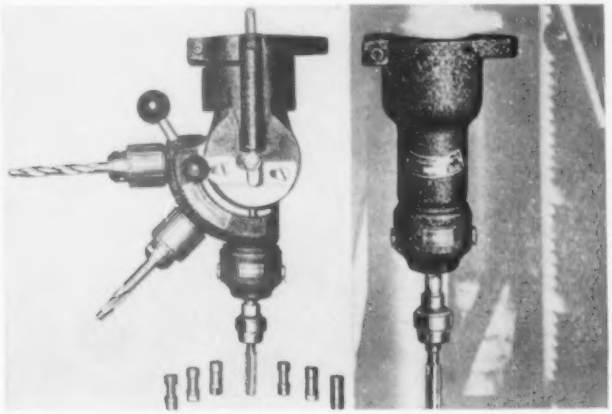
A NEW TOOL—the **STA-GA-CO ROTARY GRINDING ATTACHMENT**—distributed by *Gale Forssen Co.,* 64 Monmouth St., Springfield 9, Mass., is designed for grinding cylindrical, flat or polygon surfaces, to a high degree of accuracy, from raw hardened stock.

With it, one may grind bushings, punches, step studs, plug gages and miscellaneous pieces, all on a surface grinder. Grinding accuracy is said to be within .00005", and the 12 standard divisions accurate to 4 minutes. The tool attaches to the magnetic chuck.



New Turret Tapper

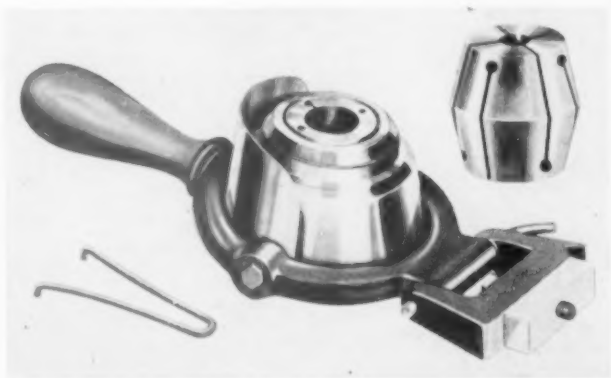
A HIGHLY FLEXIBLE tool, incorporating a reversing tapping head in one of the three positions of a **DRILL PRESS TURRET HEAD,** is now available from the *Universal Engineering Co.,* San Diego, Cal. Shop proven, the attachment is of the positive clutch type drive, with drive dogs made of Chrome Vanadium steel, hardened for long wear. A collet type chuck, of Chrome-Moly steel, has been adapted in lieu of standard tapping chucks to insure complete accuracy and rigidity. Non-collapsible, these insure accurate alignment at all times. The housing is made of double strength, close grained Dural.



The tapping head, designed for high speed operation, has a capacity of No. 8 to ½" in brass, No. 8 to ⅜" in cast iron and No. 8 to 5/16" in steel. All parts are interchangeable and fully guaranteed as to material and workmanship. As shown in the dual photo, the tapping head is available as a unit, to fit Universal Turret Heads now in use, as a component part of the new Turret Tapper and as a single unit tapping attachment for all popular model drill presses.

"Miracle" Collet Chuck

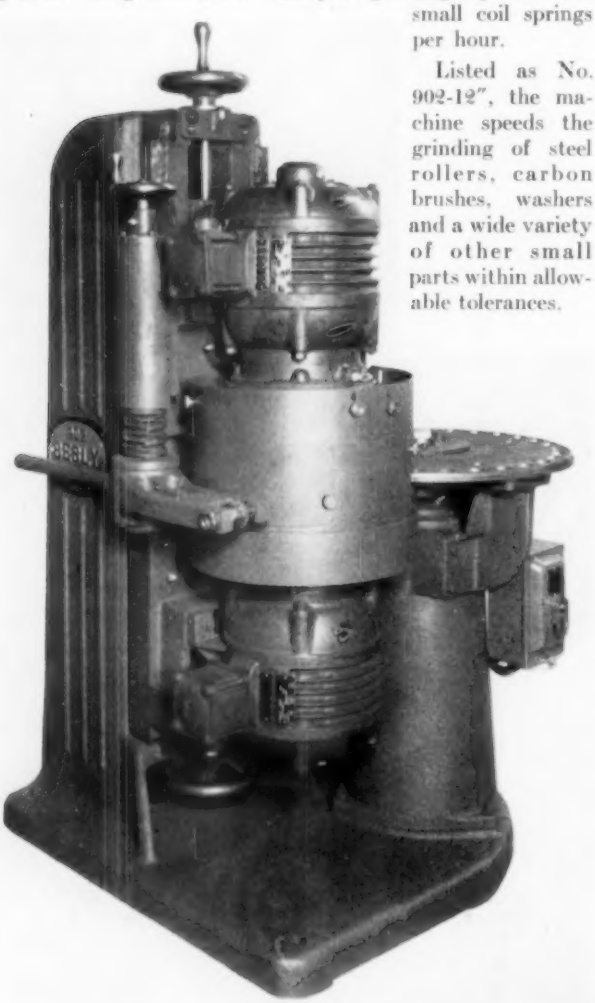
ADAPTABLE TO ANY standard bench lathe, the **NEW MIRACLE COLLET CHUCK** is now in large scale production by *Micro Parts Company,* 322½ East Beach Ave., Inglewood, Cal. The chuck can be used with stock up to one inch, permitting the full capacity of the lathe, and can be installed in a few minutes—no holes to drill and no tapping or grinding necessary.



It is a precision tool, extending only 1½" beyond the spindle nose of the lathe, that can be quickly and easily changed and, once set, cannot get out of adjustment. The entire unit revolves on the spindle which eliminates heat and friction and no bearings or retainers are employed, which does away with the need for lubrication. Additional collets are also available in rounds, squares and hexagons.

New Vertical Spindle Grinder

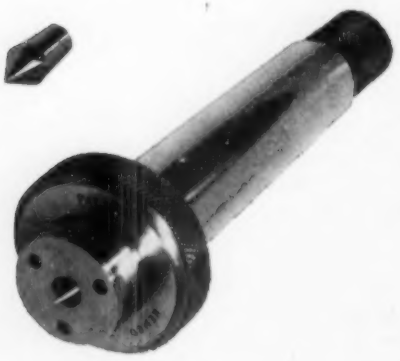
DESIGNED FOR HIGH OUTPUT on small parts, a new **DOUBLE VERTICAL SPINDLE GRINDER,** by *Charles N. Besly & Co.*, 118-124 N. Clinton St., Chicago 6, features a horizontal rotary feed which enables the operator to drop the parts into the feed wheel quickly and accurately. This feature effects substantial savings in time, with reduced operator fatigue—as, for example, grinding up to 4000 small coil springs per hour.



Listed as No. 902-12", the machine speeds the grinding of steel rollers, carbon brushes, washers and a wide variety of other small parts within allowable tolerances.

Cent-A-Matic Driver

DESIGNED FOR HOLDING in the headstock of a lathe or cylindrical grinder, a new precision tool—called **"CENT-A-MATIC"** — will largely eliminate the use of lathe dogs, with their inherent danger and out-balance at high speeds. With the new tool, which is distributed by *Acme-Danneman Co., Inc.*, 203-205 Lafayette St., New York 12, it is possible to duplicate lathe turned parts varying as much as 3/32" in depth of centering drill. Also, shouldered parts may be turned or ground to exact length dimensions.



Semi-Automatic Lathe

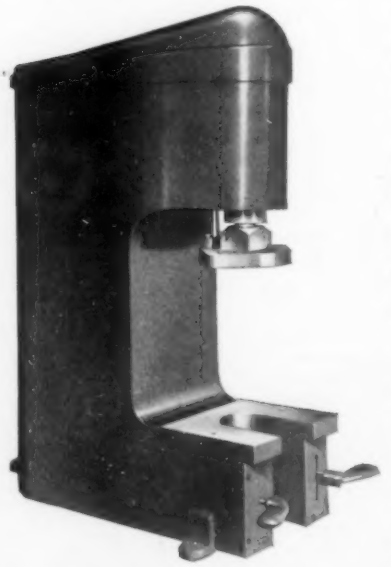
A NEW SINGLE SPINDLE **SEMI-AUTOMATIC LATHE**—No. 650—by the *Oster Manufacturing Company*, 2057 E. 61st St., Cleveland 3, features a 4 speed motor, hydraulic feeds and semi-automatic conveniences. It may be had with single or double action cross slide, as desired. The hydraulically operated cross slide, complete with necessary valves and controls, provides automatic cycle with rapid approach and retraction, feed, dwell and stop.

The motor (7½ hp) supplies direct drive for the ball bearing mounted spindle, which is equipped with push-out or draw-back collet operated by a hydraulic cylinder. Speed is controlled by a selector switch, and a thermo guard protects against overload.

A lever and solenoid operated valve controls the cross slide cylinder, and may be cut out by turning a button to "Hand," for setting purposes. Then, by turning the button to "Automatic," the cross slide is operated automatically. Ruggedly built, the machine is designed to meet conditions which demand higher production than can be attained with manually operated lathes, or where fully automatic or multi-spindle machines are either too costly or not required.

5 Ton Air-Hydraulic Press

DESIGNED TO BE a complete unit, shipped complete and ready to operate, a new **AIR-HYDRAULIC PRESS,** by *Bryant Products Company*, Jackson, Mich., is said to have an unusually high efficiency considering its normal 5 ton rating. Design is unusually clean. All working parts are contained in the housing, and there are no cams, levers, pins or gears in the power mechanism, nor intricate assemblies to get out of order. Control is by a 4-way valve.



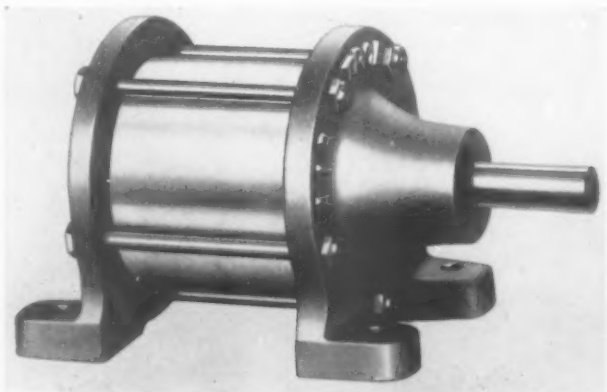
The machine is small enough for the lightest press job, yet powerful enough for many operations ordinarily requiring a heavier unit. It may be used for straightening, broaching, press assembly, riveting, stamping, embossing and countless forming and bending operations. A descriptive folder is available on request.

Die Casting Alloying Pots

GAS FIRED, **DIE CASTING ALLOYING POTS,** ranging in size from 2,000 to 10,000 lbs. capacities, with a temperature range of 350° to 1200° F., and fed with a continuous type conveyor, are announced by *Bellevue Industrial Furnace Company*, 2971 Bellevue, Detroit 7. Normally, these pots, which are used in die casting plants for reclaiming sprues and other scrap material, and can also be employed for alloying die cast metal, are designed to be fed to capacity every hour. In the case of the 6,000 lb. size, for example, the material is fed to the furnace at the rate of 1,000 pounds every ten minutes, giving a total capacity of 6,000 lbs. per hour.

New Air Control Cylinder

Air-Trol, 2651 W. Lake Street, Chicago 12, has announced a new line of air cylinders designed to expedite material holding operations for drilling, reaming, tapping, milling, grinding, injection and ejection, and numberless other operations where air power may be used for clamping or holding —or where it simplifies, speeds up or lowers the cost of jig design.



Features claimed are: (1) true-bore cylinders; (2) non-rusting cylinder heads; (3) oilless (graphite impregnated) bronze ram bushings; (4) precision assembly for smooth, trouble-free operation.

Designed for single or multiple (production line) setups, sizes range from 1½" up; power factor from 1.76 times air line pressure. Foot control (to leave operator's hands free) is available as supplementary equipment. Prices range from $12, and a unique service plan provides that any **AIR-TROL** cylinder will be restored to full working condition in event of wear through excessive use, if returned prepaid, for a fixed charge of $2.00, F.O.B. factory.

Disc Type Floor Machine

TO MEET DEMAND for improved equipment for office and factory floor maintenance, an extra-low **DISC-TYPE FLOOR MACHINE,** of new design, for polishing, scrubbing, steel wooling and other maintenance, has been introduced by the *G. H. Tennant Company*, 2530 N. Second St., Minneapolis 11, Minn., manufacturers of floor equipment.

A unique feature of the new machine is a special side-polishing brush which cleans and polishes flush with the walls, even polishing the baseboard. The brush, which has bristles extending beyond the circumference of the disc and approximately two inches high, eliminates bumping and scratching furniture. It also permits fast, easy operation under crowded conditions.

An overall height of less than 12 inches, through the use of a "pancake-shaped" motor centrally mounted over the cleaning disc, permits the machine to operate with ease in formerly "inaccessible" places such as under desks and machinery.

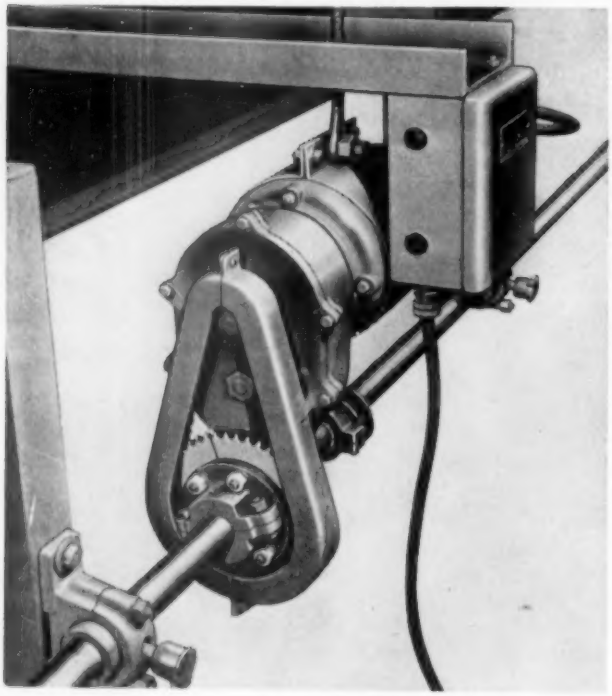
Jarvis Announces Torqomatic

THE *Charles L. Jarvis Company*, Dep't 10, Middletown, Connecticut, manufacturer of power tools, has announced the **TORQOMATIC** — a universally adaptable torque-driven tapping attachment claimed to be the most modern, most efficient and most productive tool of its kind on the market. Available in three sizes, the ultra-sensitive Torqomatics will tap from soap to copper or chrome nickel steel without an appreciable increase of the finger-tip pressure required to operate an ordinary drill press.

Jarvis Torqomatics come in standard and built-in models and can be furnished to fit any drill press or tapping machine. Precision-built by Jarvis craftsmen from the finest materials, these ultra-modern tools are available at prices that will encourage the replacement of present tapping devices and attachments. Detailed information may be had in an eight-page, fully illustrated Torqomatic folder.

Travelator for Hand Cranes

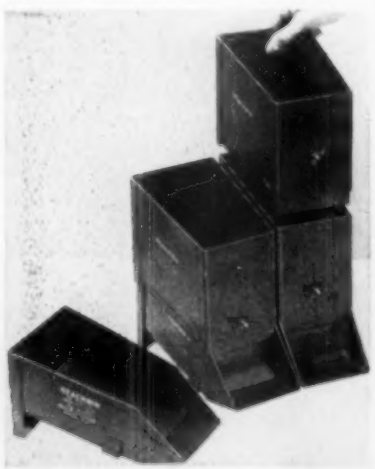
THE NORTHERN **TRAVELATOR,** manufactured by *Northern Engineering Works,* 2615 Atwater St., Detroit 7, is now available in a universal mounting which makes it applicable to any type overhead crane, both single and double girder. Nearly every arrangement of beam and hoist to be found in hand traveled cranes can be handled with this new universal mounting.



The motor is held in a steel mounting band which is connected to the mounting bracket. This mounting band may be given any position about the periphery of the motor. As a result, the motor may be given any desired position about the axis of the squaring shaft, which it drives. The variety of positions thus made available, permit application to nearly all types of hoist cranes.

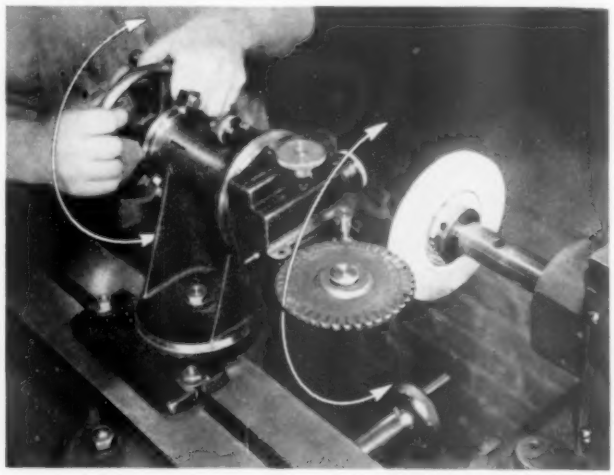
New Adjustable Hopper

A NEW, SLIDING-FRONT **ADJUSTABLE HOPPER,** designed by *Stackbin Corp'n,* Providence, R. I., after assembly line research, not only provides increased capacity for parts but also provides regulated flow of parts according to sizes and weights. Its opening can be made small or large according to the circumstances — i.e., as small parts call for large openings. When two hoppers are used, one on top of the other, the increased weight of parts, which tends to force out too many units, can be offset by regulating the size of the opening. All adjustments are easily made. Slide is held in position by wing nut for convenient adjustment; and all hoppers are made of heavy sheet steel.



Radius Grinding Fixture

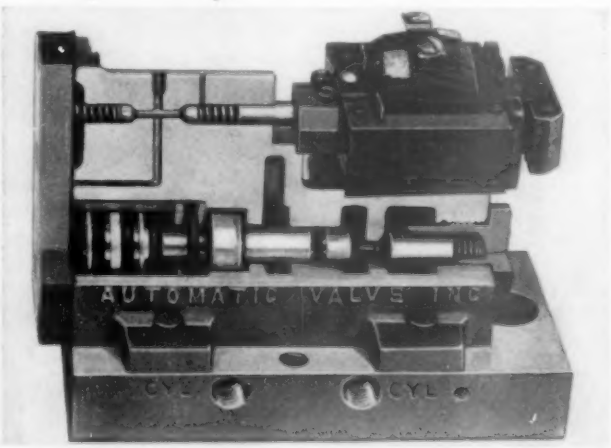
A NEW **RADIUS GRINDING FIXTURE,** by *Hill Machine Company,* 1032 Mulberry Street, Rockford, Ill., facilitates the grinding of radius side milling cutters, up to 6″ diameter, to a true radius through any arc up to 180 degrees, blending the radius perfectly into the straight lands.



The fixture, mounted on a standard tool and cutter grinder, holds the cutter in the proper relation to the grinding wheel. The radius is ground by rotating the spindle of the fixture with the hand wheel for each tooth of the cutter. A straight grinding wheel is used, with the face of the grinding wheel dressed parallel to the table of the grinder. The entire face of the wheel is used, thus avoiding wearing a groove and making repeated dressing unnecessary. A gang of cutters can be easily ground with one setup to uniform radius and diameter.

4-Way Solenoid Air Valve

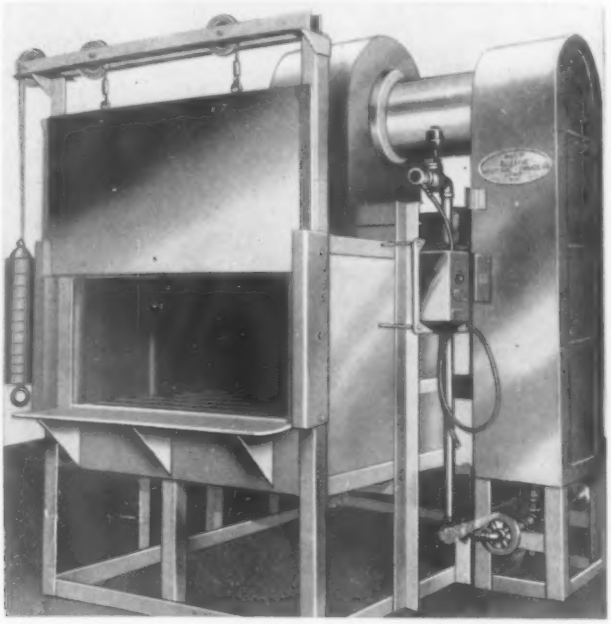
A NEW 4-way, 4-port, **SOLENOID OPERATED AIR VALVE**—Model SV-4—with positive, high speed operation and specially designed for controlling air cylinders actuating machine tool operations, has been introduced by the *Automatic Valve, Inc.,* 37415 Grand River Ave., Farmington, Mich. Small, compact and light in weight, the valve can be mounted close to air cylinders, thus eliminating excessive piping and waste of air. SV-4 is also made in 5-port type for differential air pressures, 0 to 150 lbs.



These valves are of the stemless, pressure sealed poppet-shuttle type, with short solenoid plunger travel (⅛″) and are made in ¼″, ⅜″, ½″ and ¾″ sizes. Operating power values are low—1.42 amp. in-rush at 110 volts, 60 cycles, 22 amp. sealed.

Furnace for Aluminum Alloys

A **BATCH TYPE FURNACE** for heat treating aluminum alloys, by the *Bellevue Industrial Furnace Co.*, 2917 Bellevue, Detroit, incorporates an atmospheric type burner mounted on the lower end of the duct which is used for recirculating the air back into the furnace.

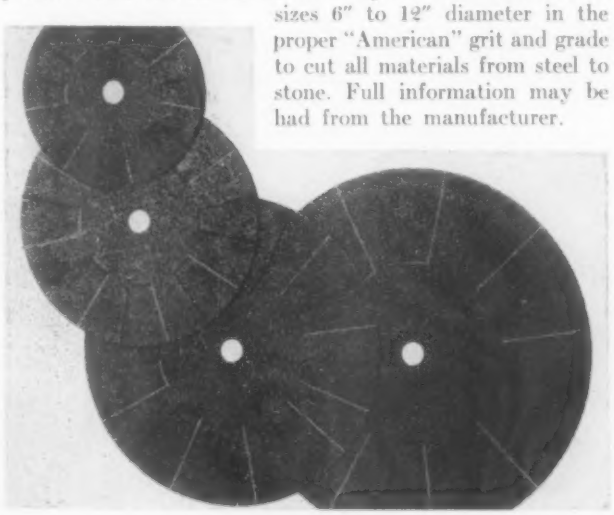


This method of heating holds the temperature with little, if any variation; besides, mounting the burner in the duct eliminates the need for an extra heating duct. For recirculation of the heated air, a Garden City high temperature fan is furnished as standard equipment.

Ripper Cut-Off Wheel

DESIGNED ON THE SAME principle as the fast-cutting ripsaw used in woodworking, a new **RIPPER ABRASIVE CUT-OFF WHEEL**, announced by *American Emery Wheel Works*, Richmond Square, Providence 1, R. I., is unique in having a "set" which allows it to cut cooler and faster, with resultant longer life. The sides of the wheel are made with radial depressions .006" to .008" deep, extending from the flange area to the edge of the wheel.

Minimum thickness of wheel is 1/16" in 6", and 3/32" in 8", 10" and 12" sizes. Extensive field tests have shown that the Ripper Wheels give outstanding performance on both portable and cut-off machines. They are manufactured in sizes 6" to 12" diameter in the proper "American" grit and grade to cut all materials from steel to stone. Full information may be had from the manufacturer.



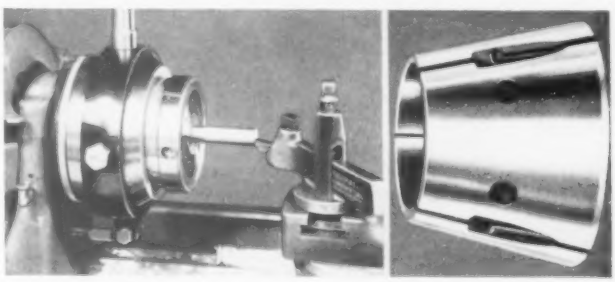
Power Squaring Shears

Parker Manufacturing Company, 2200 Colorado Avenue, Santa Monica, California, has introduced a new line of all-steel power **SQUARING SHEARS** for all types of shearing and trimming up to 14 gauge capacities. Built from extra-heavy steel plate of box type design, and welded and normalized to relieve stresses, these shears are said to possess maximum strength with minimum deflection.

Furnished with a 2 hp motor, and standing only 47" high, the tool has a low center of gravity for smooth, vibrationless operation. Cutting length is 73", blade length, 75". Back gauge range 18". Front gauge range 38". Strokes per minute (50 or 60 cycle) 85. Approximate shipping weight, 2750 lbs.

Lever Operated Collet Chuck

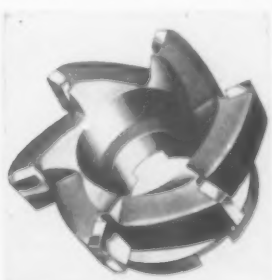
EMBODYING A NOVEL principle of construction, the Model 1-L **LEVERMATIC COLLET CHUCK**, by *Porst Bros.*, 259 No. California Ave., Chicago 12, insures a positive straight parallel grip on the work at all times; also, a steadier hold through the full length of the collet bearing to compensate for work irregularities. Capacity is up to 1".



The complete tool threads into the lathe spindle nose with minimum overhang and runout. The chuck rotates, and a hand operated shifting lever operates without heating and without need to stop the spindle. Grip is quickly adjusted to suit the heaviest cuts on solid bars, or for delicate holding of thin wire tubing or plastic parts.

New Line of Shell End Mills

THE *Vascoloy-Ramet Corporation*, North Chicago, Ill., announce their new line of Red Streak Carbide Tipped and Blue Streak Tantung Tipped **SHELL END MILLS.** Manufactured in right and left hand styles, these tools range in size from 2½" O.D. to 4½" O.D. and bores 1" to 1½".

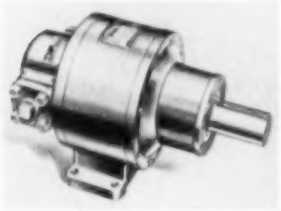


The Red Streak Carbide Tipped Shell End Mills are available with negative radial and axial rake angles, for milling steel, and zero rakes for milling cast iron, non-ferrous and non-metallic materials.

New Superdraulic Pump

AMONG THE LATEST in hydraulic appliances is the lightweight **SUPERDRAULIC JUNIOR PUMP,** which, as the name implies, is a smaller duplicate of the Superdraulic 40 hp Constant Delivery Pump manufactured by the *Superdraulic Corporation*, Miller at Ford Road, Dearborn, Mich.

Only 6 inches in diameter and 11 inches long, and weighing about 35 pounds, the Junior delivers 5000 pounds pressure in continuous service with its single bank of plungers. Capacity is 3 gpm at 1800 rpm, and 2 gpm at 1200 rpm.



Representing the compactness and high efficiency of the positive displacement pump, as developed by Superdraulic, the new pump has an extremely high volumetric efficiency—95% with the lightest hydraulic oils. The design, which incorporates radial multi-plungers, is said to provide smooth delivery with perfect hydraulic balance, the whole insuring thousands of hours of trouble-free performance.

The manufacturer predicts that the new pump, which may also be used as a powerful reversible hydraulic motor, will meet with wide acceptance for applications where space is at a premium and yet where flexibility and perfect control is demanded. Full details may be had in illustrated descriptive literature.

Horizontal Milling Unit

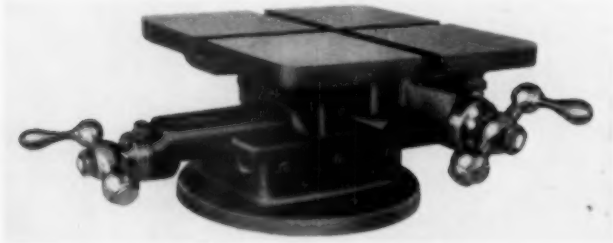
A **HORIZONTAL MILLING UNIT,** by the *Malnar Machine & Tool Co., Inc.*, 19301 St. Clair Ave., Cleveland 10, converts any Bridgeport Turret Milling Machine into a dual spindle miller with one spindle permanently horizontal. This combination eliminates errors due to resetting from vertical or angular to horizontal, and saves time in setups.

The Malnar unit, which is easily installed on the Bridgeport miller, runs on Timken roller bearings and is rugged enough for heavy end milling as well as fly cutting, boring, drilling and other operations. Complete information in Malnar Catalog TE-1.

Heavy Duty Sliding Table

A SMALL, **HEAVY DUTY TABLE,** designed for quick mounting on a drill press, is announced by *Leo G. Brown Engineering Co.*, 1127 Riverside Drive, Los Angeles 31.

The table top is 7½" square and is fitted for 1" T-bolt heads. Height is 3¾" and weight 24 lbs. The tool, which has 5" travel in either direction, has many uses, including that of an auxiliary meeting table for light work.



Versatile Wheel Dresser

CLAIMED TO BE so versatile that it provides almost unlimited possibilities in shaping, drilling, grinding, milling, or gaging operations, a new **TOOL AND WHEEL DRESSER,** by *Allied Machinists*, 6 Water St., Waltham, Mass., can be used to form any angle in addition to a number of inside and outside radii. The tool is said to offer accuracy equal to that of a height gage.

Named the Gem-Flex, the tool can be used to form tool bits, thread chasers and small dies, as an indicator stand with exceptional flexibility and as a surface gage. In the latter function it scratches circles or chords of circles in either vertical or horizontal planes. It can also be used for backing off operations, among other things.

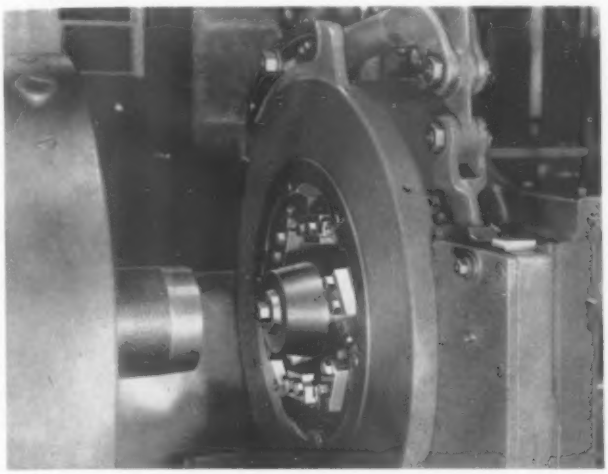
The tool is furnished complete with vise, diamond holder, ½" straight shank center and necessary wrenches, and, as an added feature, a special indicator to indicate the vertical axis when adjusting diamond clearance.

New Type Gantry Crane

PORTABILITY, ease in handling and flexibility for many varied lifting services are the features of a **NEW GANTRY CRANE,** recently announced by the *Industrial Equipment Co.*, 315 N. Ada St., Chicago 7. Of 1-ton capacity, with generous safety factor and minimum gantry weight, it has a broad variety of uses at loading platforms and docks, in power plants, machine shops, factories and garages and for construction, maintenance and farms. The crane is fully described in Bulletin PG-648, available on request.

Centering Pilot By Landis

A **SPRING PILOT,** developed by the *Landis Machine Company*, Waynesboro, Pennsylvania, is designed for centering pipe in their 8⅝" and 13⅜" Receding Chaser Pipe Threading and Cutting Off Machines. Since, however, its use necessitates the removal of the cutting off slides, the machine is limited to threading only when equipped with the Spring Pilot.



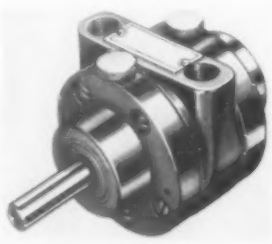
The Spring Pilot, with its 10° angle for use with different wall thickness, forms a center in the bore of the die head for centering the pipe with the die head. Therefore, only the rear chuck of the machine is used to grip the pipe during the threading operation. It is necessary that the front chuck clear the pipe by approximately ⅛" to permit the pilot to fully engage the bore of the pipe.

In operation, the pilot is forced forward by a spring and engages the bore of the pipe prior to the pipe advancing to the chasers. The spring forces are taken up by an anti-friction bearing. When the pilot is changed for different diameters of pipe it is only necessary to remove one screw in the center.

The principal advantage of the Spring Pilot is that it centers the pipe true with the die head, assuring concentric threads and a higher threading speed. Chatter is eliminated and the chasers can be set further back of center, thus increasing the clearance back of the cutting edge. This setting of the chasers greatly increases tool life and materially improves thread finish.

Explosion-Proof Air Motor

Gast Manufacturing Company, Benton Harbor, Michigan, announces a new **EXPLOSION-PROOF AIR MOTOR**—Model No. 1. This relatively low-priced, 2½ pound, 2¼" diameter model may be used in place of electric motors on portable or stationary equipment, as it meets all safety requirements.



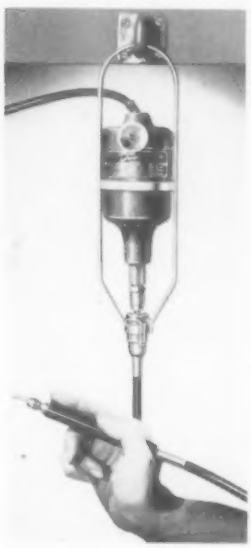
This new air motor is of typically simple Gast design. Four one-piece sliding vanes, fitted in a shaft-mounted rotor, slide outward by centrifugal force, in a shell, and present their surfaces to the incoming air to cause rotation. The motor starts in any position, will not spark, nor burn out due to overload or sudden braking. It runs under constant low speed, as 100 rpm, without stalling. Speed varies from 0 to 6,000 rpm; hp from 0 to 1/6.

New Dumore Handgrinder

A NEW **ELECTRIC HANDGRINDER,** the Duplex, is announced by *The Dumore Company*, Racine, Wis., as an addition to their line of precision tools and grinders. This dual-purpose tool may be used as a straight hand grinder; or, by means of conversion attachment, as a flexible-shaft tool.

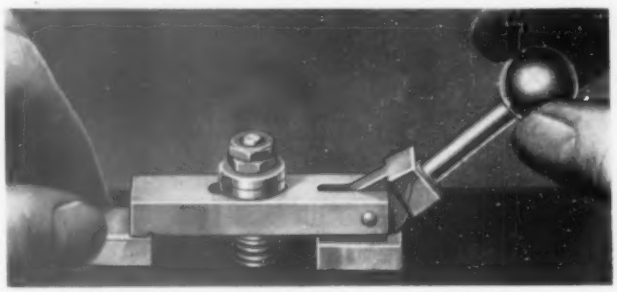
The attachment includes a hanger, in which the Duplex is clamped, a 36" flexible shaft, and a choice of three different handpieces, all designed to provide a selection according to the requirements of the work to be done. Two other attachments are available, converting the Duplex for bench and lathe-mounted operations.

The tool is powered by a full 1/14 hp motor, equipped with "long-life" sleeve bearings. Its ¼" capacity chuck can be adapted to 3/32" and ⅛" shank tools, with collet sleeves provided, and can therefore use all three standard sizes of mounted tools to do a variety of jobs in wood, metal, and plastics—as sanding, sharpening, grinding, sawing, drilling, polishing, and many others. The Duplex is offered as a handtool in two different kits: the standard, which includes 9 different accessories—mounted wheels, files, arbors; and, the deluxe kit (shown) which has 27 different accessories packed in a substantial case of polished wood. The new tool will have wide usefulness as an economical industrial grinder, in addition to its appeal to hobby enthusiasts as a home workshop tool.



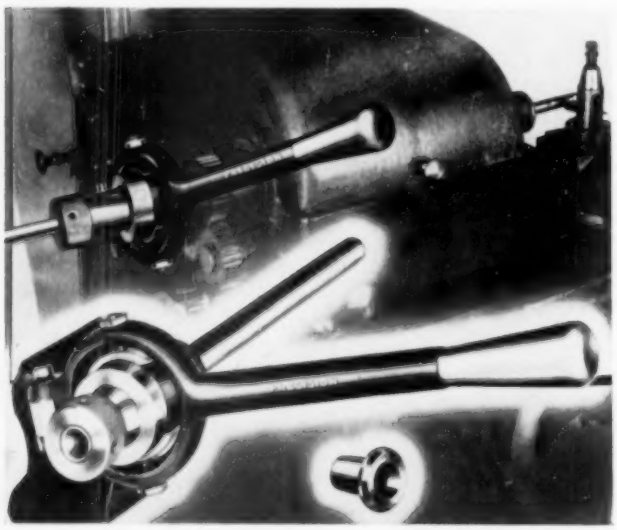
Midget Fixture Clamps

OF PARTICULAR INTEREST to designers and toolmakers is a new series of very small **FIXTURE CLAMPS,** by the *West Point Manufacturing Company* of 19625 Merriman Court, Farmington, Mich. Called the Midget, this series consists of 4 styles of clamps (including quick action) of very small size for the easier holding of small workpieces. The clamp strap is only 2½" x ⅝" x ⅜" in size, yet each clamp is made in exact proportion to the larger WESPO clamps and with spherical washers with ground radii to compensate for irregularities in the work. Made of steel, heat treated and cadmium plated, all WESPO midget clamps are available for immediate delivery.



Precision Drawbar

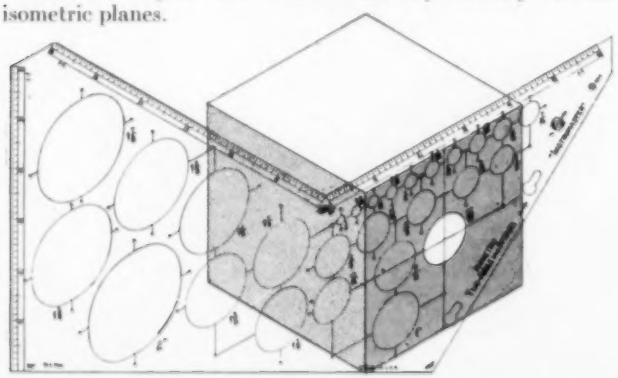
THE NEW IMPROVED Precision **LEVER-TYPE DRAWBAR,** illustrated below, is designed for production use on such popular half-inch collet capacity lathes as the Atlas, Logan and South Bend, and is particularly desirable for its ease of operation and for use where there is a slight variation in work diameter. Developed by *General Die and Stamping Company*, 262-272 Mott St., New York 12, N. Y., it is provided with a positive gripping tension which, applied over a range of three adjustments, automatically adapts itself to the diameter of stock whether it be undersize, oversize or standard, and without the necessity of taking the unit apart.



This attachment is completely rigid, so that there is no chatter even at highest speed; while the high leverage reduces operator fatigue so that it is ideal for use by women operators. The new drawbar employs General Die's patented coordinate cam principle which reduces friction to a minimum and eliminates the need for fingers. Its design simplification also results in fewer parts to wear out.

Improved Drafting Tools

AMONG NEW **DRAFTING INSTRUMENTS,** by *Instrumaster Industries, Inc.*, 73 Arch St., Greenwich, Ct., is the Gilmour "Instrumaster," an Isometric Protractor enabling draftsmen to plot and measure directly on any of the isometric planes.



Another group of new instruments includes "floating triangles," made from clear, non-warping and non-inflammable material. This line comprises 45° and 30/60° styles in sizes 4" and 12". A 20-page illustrated booklet on "Axonometric Drawing . . . the universal picture language," explaining the fundamentals of three-dimensional illustration and its advantages may be had for 10c, covering postage and handling.

New Variable Speed Drive

DESIGNED TO MEET any fractional hp drive requirement, a new **VARIABLE SPEED POWER DRIVE,** by the *Flinchbaugh Company*, 750 South Court St., York, Pa., has a range of from 20 to 750 rpm with 1725 rpm motors. Reduction to 4 rpm can be had with an auxiliary shaft.

Base and housing are of aluminum, for light weight (total 12 lbs); and the unit can be quickly and easily changed from one piece of equipment to another. The unit has universal mounting for ½ hp motors, and under; and either direction of shaft rotation can be had by mounting right or left on the base. Request Bulletin No. 02 when writing for further information.

Flat Lapping Machine

A NEW PRECISION machine tool called The Spitfire **FLAT LAPPING MACHINE,** by the *Spitfire Tools, Inc.*, 2933 Pulaski Road, Chicago 41, is designed and built for highly accurate flat lapping operations on both large and small surfaces. This machine quickly produces the perfectly flat planes necessary in sliding and rotating parts, air and liquid tight seals, flat surfaces of plastic molds, drawing dies and pressure pads.

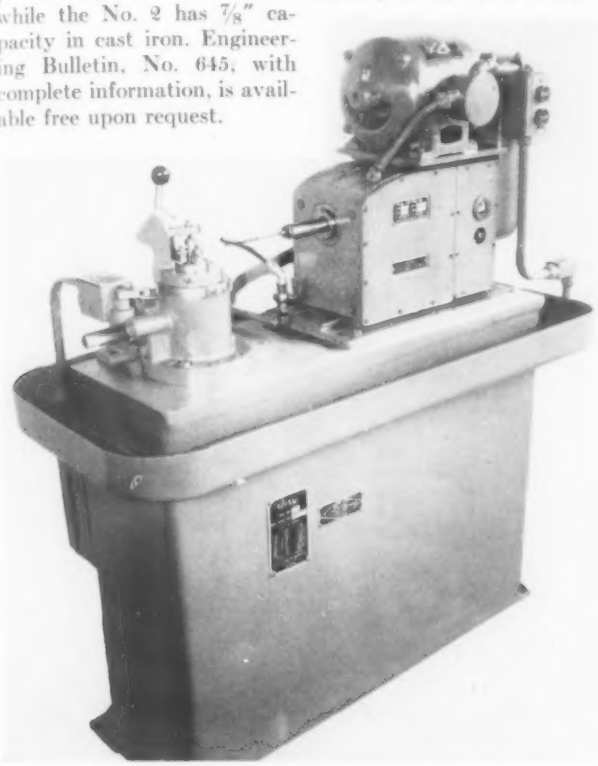
High polish and precision flat finish, as fine as 2 rms microinches, are rapidly and easily lapped on metals, and also on glass, quartz and other materials where an extremely flat surface is important. Single pieces ordinarily require no holders, chucks or collets. The operator holds the piece on the revolving lapping plate and directs its motion with his hands. Production lapping of large quantities of small parts may be quickly accomplished by using standard or special holders.

Sturdy and compact, and precision built throughout, this new Spitfire Flat Lapping Machine is made with all gears and bearings sealed for life. Extra Lapping Plates, standard or special for various uses, available at low cost, are easily installed or removed without tools, as no bolts, screws or other fastenings are used.

New Cam Feed Units

THE *Avey Drilling Machine Company*, Cincinnati, Ohio, announce the No. 1 and No. 2 **CAM FEED UNITS,** developed for drilling, reaming, counter-boring and tapping. These are self-contained units with electric controls for operating and synchronizing multiple unit setups.

These Cam Feed Units have almost unlimited applications to special machines, and completely eliminate manual operation of spindle. Hence, operator fatigue is reduced, with commensurate reduction of man hours and consequent higher production at a lower labor cost. Illustrated is a standard Avey Cam Feed Unit tied into an automatic indexing fixture—a job similar to drilling smoke holes in pistons. The No. 1 unit has a capacity of ½" in cast iron, while the No. 2 has ⅞" capacity in cast iron. Engineering Bulletin, No. 645, with complete information, is available free upon request.



New Type Solenoid Valve

THE *Henry Valve Company*, 3260 W. Grand Avenue, Chicago 51, announce their new Type SV-11 **SOLENOID VALVE,** designed for small capacity installations involving the use of freon, methyl chloride, water, oil, air and gas.

Incorporated in a standard outlet box, it can be quickly mounted through screw holes provided; and electrical connections can be easily made utilizing one of three knockouts in outlet box. It can also be mounted in approved metal enclosure, less outlet box.

The valve meets all requirements of the Underwriter's Laboratory. The coil can be removed and replaced without disturbing electrical connections to thermostat or other electrical devices. Efficient magnetic circuit provides low current consumption and a "floating plunger" insures quiet operation. It is furnished, with ⅜" FPT connections, for 115 volt, 60 cycle, and 230 volt, 60 cycle. Lock nuts are threaded on body for mounting.

Small Knee-Type Miller

MODEL NO. 0000 **KNEE-TYPE MILLING MACHINE,** by *Childs & Co.*, Conneaut, Ohio, is a low cost, accurate and sturdy miller expressly designed for the manufacture of small parts, and is ideally suited to the needs of watch, instrument and model makers, gunsmiths and hobbyists, as well as for laboratory, toolroom and gage shop uses.

The capacity of the unit is indicated by the feeds: longitudinal 6", transverse 1½", and vertical 4". Movement of the table in transverse, longitudinal and vertical directions is held to .001" in accuracy; and .0001" tolerance applies to runout of the spindle.

Rugged and compact, yet only 14½" high, and weighing but 75 pounds, the basic unit illustrated may be used for bench or table model operation; or, when used with the pedestal base (offered as an accessory) the unit can be used as a floor-type milling machine. In either case, the double V-belt drive comes up through the column. Nine changes of speed range from 280 rpm to 11,150 rpm.

The ground alloy steel spindle has No. 5 B & S Taper. The overarm is solid rectangular type, sliding in scraped dovetailed ways, and clamped in place by two locking levers. The arbor support has either bronze or Torrington needle bearing, oiled from a cup in the support. Spindle bearings are of sealed construction, lubricated for life, and longitudinal, transverse, and elevating screw bearings are similarly constructed and lubricated. Four adjustable dials have knurled locking screws, and are graduated in 100 graduations, each graduation being .001". All feed screws are of Acme form thread. A ½ hp motor is generally recommended, but a 1/3 or even ¼ hp fractional motor may be used for lighter cuts. Descriptive literature available.

New Line of Masonry Drills

Vascoloy-Ramet Corp'n. North Chicago, Ill., announces its new line of Red Streak **CARBIDE TIPPED MASONRY DRILLS,** designed for drilling non-metallic materials 75% faster than with ordinary steel drills. Constructed with generous sized carbide tips, these drills are obtainable in off-set and straight shank designs in drill diameters of .198" to 1.535".

Adaptable for any rotary powered or hand drill, the Red Streak masonry drills are specifically designed to drill concrete, brick, tile, slate and all other non-metallic materials. They eliminate premature drill wear, excessive drilling time, and noisy percussion hammering encountered in previous drilling practices.

Improved Milling Attachment

THE *H. Leach Machinery Company*, Providence, R. I., exclusive distributors for the Fray Machine Tool Company of Glendale, Calif., has announced important improvements in the Fray "All Angle" **VERTICAL MILLING ATTACHMENTS.** These attachments are manufactured in four types, each incorporating distinctive features.

In order to bring Attachment Type One up to the working ability of Types Two and Three, the ½ hp motor previously used has been replaced with a ¾ hp heavy duty motor as standard equipment at no additional cost. While Types One, Two and Three Attachments will retain the present wide range of spindle speeds (375 to 5200 rpm); Type Three will be available with back gearing, providing two additional low speeds: 125 and 250 rpm. This is an exclusive patented Fray feature.

The Type Four "All-Angle" Milling Attachment is a heavier unit, designed for use on No. 2 and heavier milling machines, engine lathes, planers and boring mills. Its housing has been redesigned so that, in appearance, it will be the same as Types One, Two, and Three. It will also be supplied with a 1½ hp heavy duty motor in place of the 1 hp previously used; while the spindle has been redesigned to take the No. 30 National Standard Taper instead of the No. 9 B & S or No. 3 Morse taper as in previous design.

A complete line of standard adaptors is stocked for various sizes of over-arms, and special adaptors will be available to specifications.

New Drafting Scale

A NEW DRAFTING scale—the **VANT RULE,** by the *Stewart-Jackson Instrument Company*, 215 West 7th Street, Los Angeles 14, Cal., incorporates eight different scales on one side—hence, no need to turn it over to find calibrations of ⅛" to 3", per foot. The rule, which retails for $2.00, is of heavy plastic, with calibrations and numerals in red.

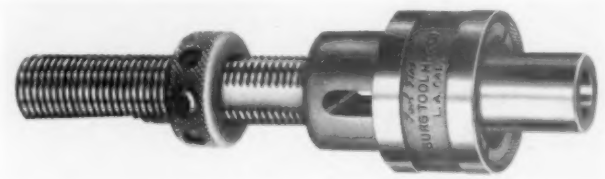
New Spiral End Mills

A NEWLY PATENTED **END MILL,** with progressive spiral taper, by the *Helical Cutter Company* of 15536 Telegraph Road, Detroit 23, is claimed to shear evenly throughout the length of the cutting edge, and to cut faster and freer with a much longer useful life. This end mill maintains an approximately constant helical angle through the cutting edge; and, because of its developed spiral, has the same shearing action and cutting action at all stages of cutting. It can be faced and sharpened with the ease of a straight end mill.

Made of selected high speed steel with flutes polished out—thus eliminating excessive loading of flutes by non-ferrous metals—Helical end mills are claimed to be ideal for all machine shops, and are specially suited for pattern work. Made 4-fluted, with right hand cut, they are available for immediate delivery in sizes ranging from 1" to 6" flutes, and with 1 to 3 degrees taper. The manufacturer will gladly furnish additional information on request.

Holder for Close Tapping

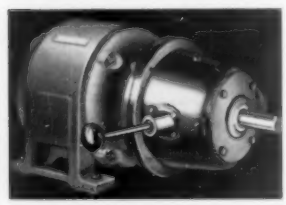
HOLES ONLY 15/16" center to center can be tapped with a new Neoprene-mounted, positive drive, Tool-Flex **TOOL HOLDER,** a recent development of the *Burg Tool Manufacturing Company*, 5028 West Jefferson Blvd., Los Angeles 16, California. Full floating mounting eliminates bell mouthing and oversize holes.



The new tool holder has Acme-threaded shanks for use on multiple-spindle tapping operations. Only four parts make up this product: shank; collet; oil-resistant Neoprene mounting, used to minimize tap breakage and to compensate for misalignment; and locking ring. All metal parts are precision ground of heat treated, alloy steel.

2-Speed Motor Transmission

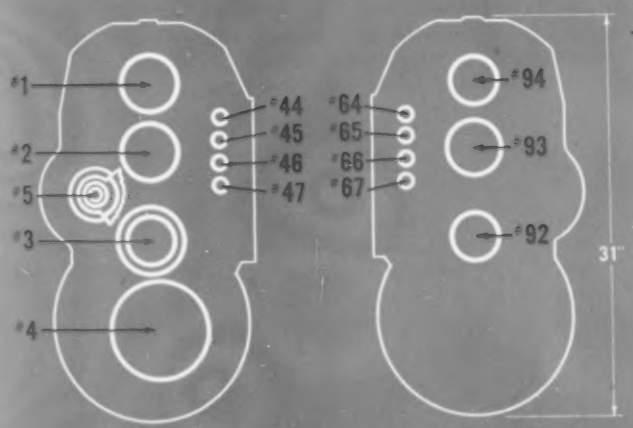
A TWO-SPEED **MOTOR TRANSMISSION,** by the *Western Manufacturing Company*, 3400 Scotten Ave., Detroit 10, may be used to replace two-speed motors, with the added advantage of special ratios not obtainable with standard two-speed motors. Direct motor speed, neutral point, and any desired reduction up to 6.25 to 1 are obtained through an automotive-type gear shift lever. Standard reductions are 1½ to 1; 2 to 1; 3 to 1; and 4 to 1. Units manufactured to apply on motor frames Nos. 224, 225, and 254 (shown) are mounted upon flanged-type end shield and can be swiveled 90 degrees, so that the shifting lever may be in any one of three different positions—either of two horizontal and one vertical. In the larger sizes these new Western two-speed Transmissions are made with modified base mounting, corresponding with legs of motor frame. Four to six week delivery can be given on standard models.



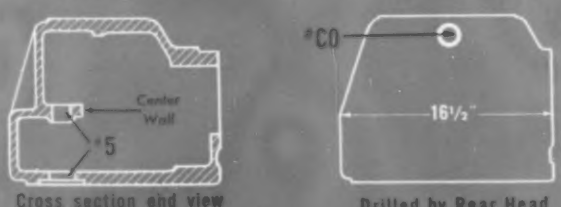
Multi-precision boring plus production

NATCO BORING MACHINE

bores holes ranging from .993" to 8.064" diameter



First Wall Operations — Second Wall Operations



Cross section end view to show #5 hole — Drilled by Rear Head

Seventeen transmission case holes up to 8.064" diameter are bored simultaneously within .001", plus or minus, and one hole drilled, on this NATCO special 3-way horizontal boring and drilling machine. The machine is arranged with hydraulic feed. Stationary type fixture accommodates one part while the operations are performed.

RIGHT-HAND HEAD. Combination rough and finish bore Hole #1 in first wall to 3.037" diameter and Hole #94 in second wall to 3.347" diameter. Combination rough and finish bore Hole #2 in first wall to 3.937" diameter and Hole #93 in second wall to 3.937" diameter. Combination rough and finish bore and counterbore Hole #3 in first wall to 3.751" bore and 5¼" counterbore and combination rough and finish bore Hole #92 in second wall to 3.672" diameter. Combination rough and finish bore Hole #4 in first wall to 8.064" diameter. On Hole #5, first wall, combination rough and finish bore to 2" and counterbore to 3 9/16" diameter; on center wall, combination rough and finish bore to 1.385" and face boss to 1¾" diameter. Ream four holes #44 to #47 inclusive to .993" diameter.
LEFT-HAND HEAD. On 4 holes #64 to #67 inclusive, combination finish ream to .993" and counterbore to 1½" diameter.
REAR HEAD. Drill one hole #60 for 1" pipe tap.

Production is 13 transmission cases *precision bored* per hour. For further details on NATCO boring and drilling machines, write today to NATCO, Dept. T, Richmond, Indiana.

NATCO

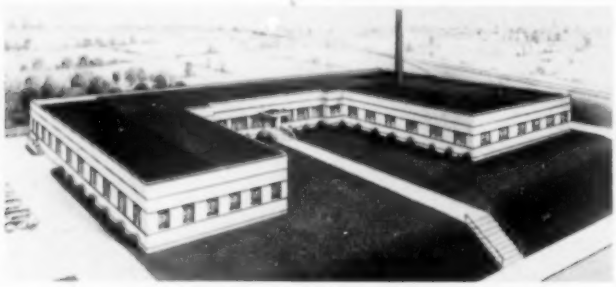
NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND., U. S. A. • *Branch Offices:* 1809 Engineering Building, Chicago • 409 New Center Building, Detroit • 1807 Elmwood Avenue, Buffalo • 2902 Commerce Building, New York City

North East West South in Industry

WALTER S. BEECHER has been named Southwestern Dis't Sales Mg'r with headquarters in Dallas, Texas, for **Jas. H. Matthews & Company** of Pittsburgh. Formerly Matthews' Cleveland sales representative, Mr. Beecher has specialized in sales, and development of all types of industrial marking machines.

Edward Greenspon, Detroit, has assumed ownership of the **UTICA MACH. COMPANY,** Washington, Mich.

General sales offices of the **DoALL CO.,** and **DoALL INTERNATIONAL CO.,** have been moved to new quarters at 254 N. Laurel Ave., Des Plaines, Illinois.



GALE H. FISHER, recently appointed Office Mg'r, Detroit Branch, **Republic Drill & Tool Co.,** served for the past four years in a similar capacity with B-H Tool & Supply Co., Detroit. For 20 years prior to that, Mr. Fisher was buyer for Chevrolet Gear & Axle, Gen'l Motors Corp'n, Detroit.

JOHN G. FRITZINGER, associated with the **Carborundum Company** as a sales eng'r since 1924, has been promoted to District Sales Mg'r of the company's Philadelphia office, succeeding Williard J. Griffith. The latter has formed a new supply company with Paul E. Raguse, principally for the distribution of Carborundum products in Philadelphia.

Four new jobbers for Industrial Air Tools manufactured by **ARO EQUIPMENT CORP'N,** Bryan, Ohio, are: **Grayson-List & Co.,** Jersey City, N. J.; **Erie Mfg & Supply Co.,** Erie, Pa.; **Bay State Supply Co.,** Cincinnati, Ohio; and **Wilkinson-Kompass Ltd.,** Hamilton, Ontario, Canada. Also, in Canada, the **Welders Supply Co.,** Toronto, Ontario, has been recently appointed jobber for the Aro scaling hammer.

HOWARD W. DUNBAR, vice-president and gen'l mg'r, **Grinding Machine Div'n, Norton Co.,** who was recently retired from active service, first came to the company in 1913, as ass't chief eng'r to Charles H. Norton. Mr. Dunbar will still be retained, however, by Norton Company as a Consultant and will act in an advisory capacity.

JOHN A. MARKSTRUM, formerly chief eng'r, Continental Tool Wks, has joined the staff of **Apex Broach Co.,** Detroit, according to G. E. Headbloom, Apex President. Mr. Markstrum, widely experienced in design and as an executive, is a past Nat'l Director, A.S.T.E. He is a member of the Detroit Chapter, A.S.T.E., and also of the Eng'g Society, Detroit.

SHEFFIELD CORP'N, Dayton, Ohio—recent purchaser of the plant, equipment and business of the **Threadwell Tap & Die Company** of Springfield, Mass.—announces that this new acquisition represents but another forward step in a long term expansion program now underway at Sheffield.

University Extension Div'n, University of Wisconsin, Madison, Wis., announces formation of a new correspondence course, **"INDUSTRIAL SAFETY ENGINEERING,"** for the benefit of those having to do with safety rules in industry. The fee for those living in Wisconsin is $15; out of state, $24.

ROBERT W. LARSON, named Administrative Ass't to the Director of **General Electric's** Research Laboratory at Schenectady, will aid the Director, Dr. C. G. Suits, in work on new facilities, including the Knolls Atomic Power Laboratory, which General Electric will operate for the United States Government.

JOHN L. NEWELL has joined the **C. M. Smillie Co.,** Detroit—manufacturers of tools, gages, fixtures and precision screw machine products—as Sales Representative in the Eastern territory. Mr. Newell's headquarters will be at 2 Salem Place, Livingston, New Jersey.

COLUMBIA TOOL STEEL COMPANY, announces that **Richard W. Miller,** formerly ass't mg'r at Cleveland, will be the new District Sales Mg'r in charge at Chicago.

BROWN & SHARPE MFG CO., Providence, R. I., announces that **Harry G. Leighton** is retiring after many years of service, the last 32 years of which he was in charge of the Philadelphia office. He will be succeeded by **Thos. F. MacLaren** who has been connected with the Philadelphia office since 1935.

Hiram Ash, President, **NATIONAL TOOL SALVAGE COMPANY** of 6511 Epworth Blvd., Detroit, announces opening of expanded quarters in the company plant for the salvaging of tungsten carbide tipped cutters. Additional specialists have also been added.

Cost of machine frame reduced 50% by change to welded design

BY LOUIS FAULB, PRESIDENT
KLEEN-KUT MANUFACTURING COMPANY
CLEVELAND, OHIO

Production cost of the frame of the Kleen-Kut meat saw manufactured by our company has been reduced more than 50% by redesigning it for fabrication by arc welding. The former design and the latest welded design are shown in Fig. 1.

The new design has reduced machining operations 60%, has made the machine six times as rigid, cut its weight from 550 to 350 pounds, and has doubled the production output of the same floor area.

The changeover to all-welded design was an evolutionary process over an 18-month period.

We started with the table frame shown in Fig. 3, and the cost reduction encouraged us to redesign the whole machine. Since our original all-welded design, we have made 40 improvements. If we had used conventional fabricating methods, 40 modifications or complete changes in patterns would have been necessary. Open views of the original welded design and the latest welded design are shown in Fig. 2.

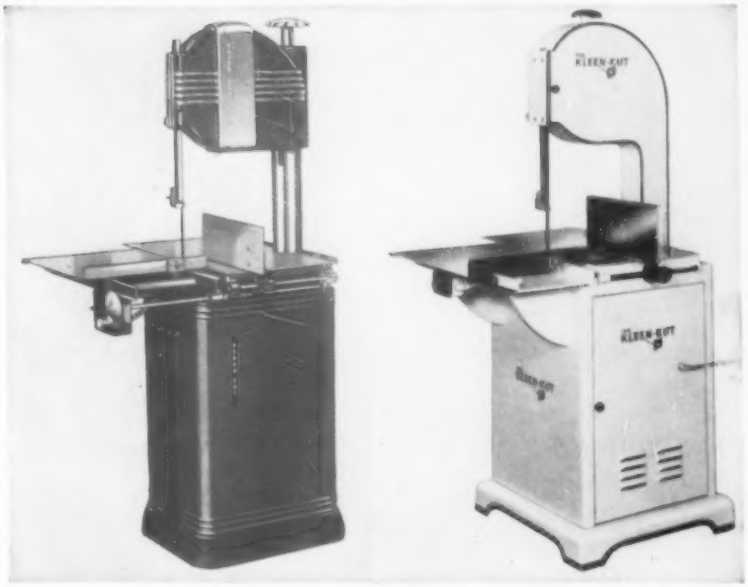


Fig. 1. Saw of former conventional design (left) and all-welded design (right).

IMPROVES THE PRODUCT

Welded design has increased the saw's overall rigidity and strength. The top pulley support, subject to considerable stresses, was stiffened by simply welding a 32-inch length of angle vertically inside the housing. Rigidity was further aided by widening the main frame to the full length of the base and redesigning the door.

Adjusting the saw blade tension in the former model required moving the entire head of the unit up or down, which took too much time. In the new design this adjustment is made by simply turning a rod. To incorporate this feature in the former design would have meant an excessive amount of machining.

INTERMITTENT WELDS USED

The new saw frame is made largely of formed plates, reinforced at strategic stress points with gussets and cross-braces. A minimum of material and welding is used, most parts being fused with intermittent welds like those in the table frame (Fig. 3). This type of welding obtains proper strength, avoids distortion and speeds production.

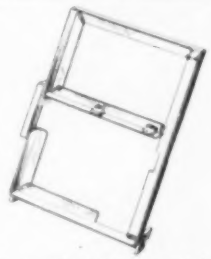


Fig. 3. Table frame, made from angles. This is the first part that was changed to welded design.

The table frame is constructed of 1½-inch angles with ½-inch bearing brace. The machine base consists of four ¼-inch plates joined by fillet welds in open corner joints. The main stand is 3/16-inch-thick steel sheet with inside fillet joints. Bearing and pin bosses are solid welded into the structure. Hinged covers are 14 gauge steel sheet.

Wherever possible, welding is done on the inside of the joint to give a smooth exterior appearance. Because materials are light-weight, all parts can be easily handled for bench-welding.

The reduction in machining operations has enabled us to double our production within the same floor area. Materials-procurement has also been simplified. Previously we ordered parts from seven outside firms; now we make them all in our own plant with simple, low-cost production facilities.

In approaching redesigning problems, our engineers have been aided by the Studies in Machine Design issued periodically by The Lincoln Electric Company. These are available free to engineers and designers who write The Lincoln Electric Company, Dept. 411, Cleveland 1, Ohio.

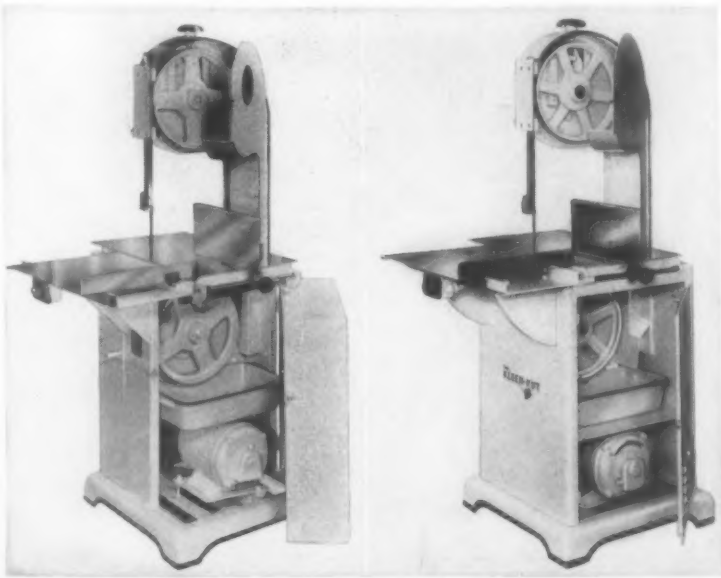
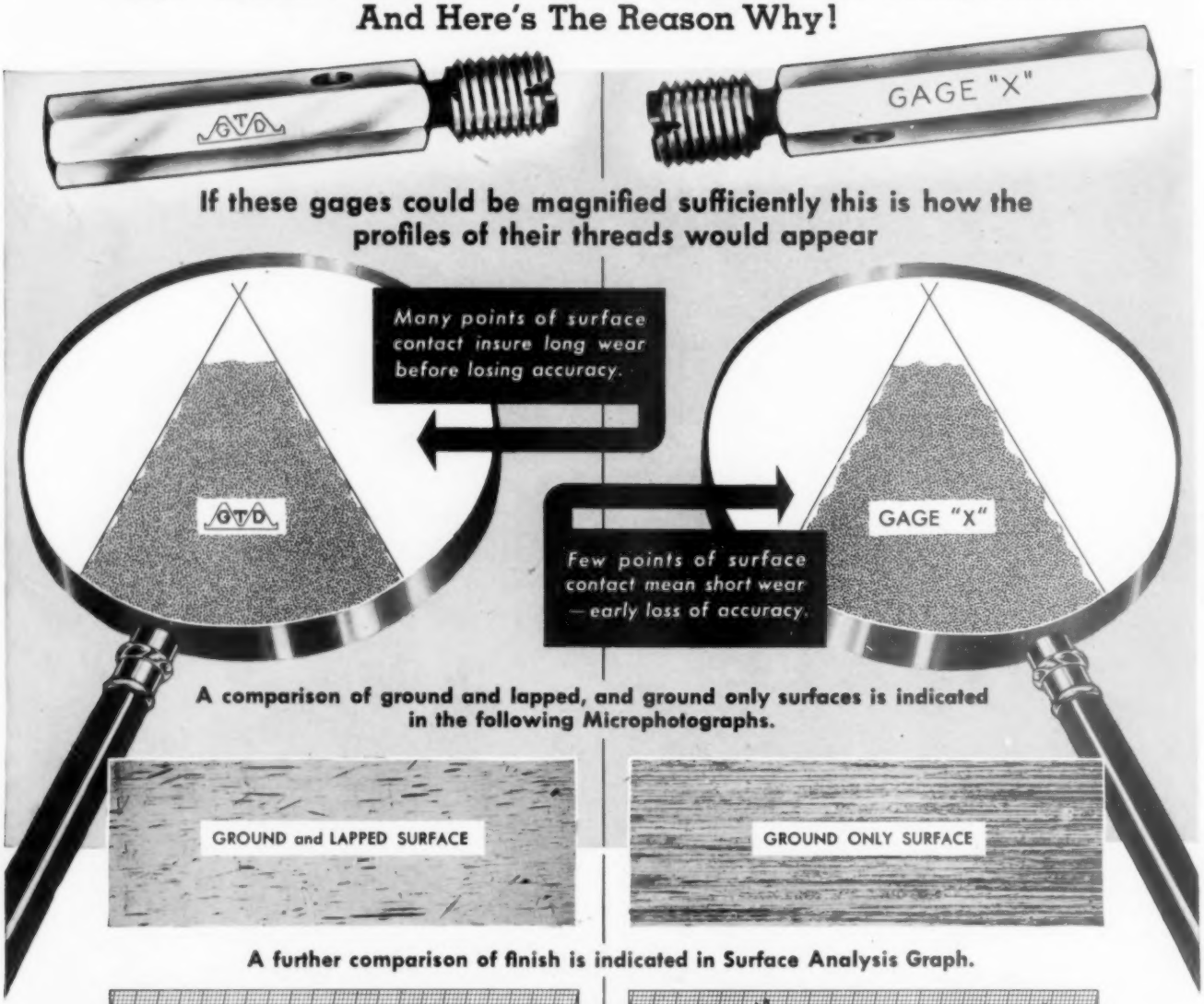


Fig. 2. Original welded design (left) and latest welded design (right) with covers open to show interiors.

(Advertisement)

They Look Just The Same, BUT....

The "Greenfield" Gage Will Outwear Gage "X" Many Times. And Here's The Reason Why!


GTD
GAGE "X"
If these gages could be magnified sufficiently this is how the profiles of their threads would appear
Many points of surface contact insure long wear before losing accuracy.
GTD
GAGE "X"
Few points of surface contact mean short wear — early loss of accuracy.
A comparison of ground and lapped, and ground only surfaces is indicated in the following Microphotographs.
GROUND and LAPPED SURFACE
GROUND ONLY SURFACE
A further comparison of finish is indicated in Surface Analysis Graph.
GROUND and LAPPED SURFACE
GROUND ONLY SURFACE

Both gages will pass all measurement requirements. But the "Greenfield" Gage, because of its finely lapped surface, will outwear the other many times. *All* "Greenfield" Gages are lapped to an extremely high degree of finish. This "inbuilt" extra wear which gives long and accurate service and better value to users, is one reason for "Greenfield's" reputation in the gage field. *For better gaging, "GO" Greenfield.*

GTD Greenfield 75th YEAR

GREENFIELD TAP and DIE CORPORATION · Greenfield · Massachusetts
and its New Haven Division The GEOMETRIC TOOL COMPANY

Danly Die Sets and Die Makers' Supplies Speed Production

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DANLY PRECISION DOWEL PINS are accurate through their entire length . . . Diamond tested for hardness (58-60 Rockwell-C) . . . Ground to a tolerance of .0001".

Photo—Courtesy of Croname, Inc.

DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. The mechanic can drive the knurled head a good part of the way before using the wrench. Infinite applications—a wide range of sizes.

DANLY KWIK-KLAMP TOGGLE CLAMPS combine strong construction and simplicity of operation—used wherever quick, positive clamping action is required.

DANLY DIE SPRINGS are noted for staying power and high resistance to fatigue. Two complete lines: *Medium Pressure—High Deflection; High Pressure—Medium Deflection.*

DANLY SOCKET-HEAD STRIPPER BOLTS. Made of high-grade steel, these stripper bolts have the same knurled socket-head found in Danly Cap Screws.

DANLY DIE SETS are famed for precision and known accuracy in Die Shops and Stamping Plants everywhere. Many types and sizes in Steel, and Semi-Steel.

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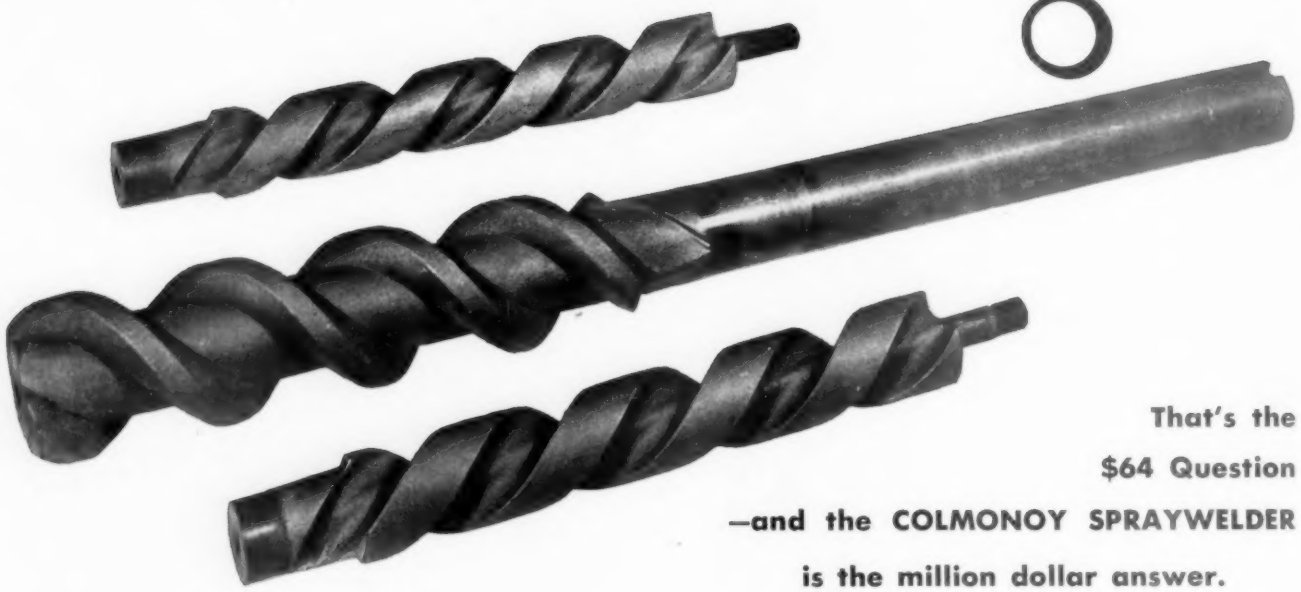
- **DUCOMMUN METALS & SUPPLY CO.** — *4890 South Alameda, Los Angeles 54*

Danly Tool, Die and Gage Makers' Supplies

HOW WOULD YOU HARD-FACE These Parts ?



That's the $64 Question —and the COLMONOY SPRAYWELDER is the million dollar answer.

These parts have to be extremely resistant to both corrosion and abrasion. In addition, they have a rather intricate design which presents quite a hard-facing problem, inasmuch as they must be finished to ± .001" on all dimensions. Conventional hard-facing methods, of course, could not be considered.

With the COLMONOY Sprayweld Process, however, this is just another routine job. The parts were first grit-blasted, after which an overlay of Colmonoy No. 6 was sprayed on and then fused to the base metal. Distortion and warpage, .001.

Amazing? No more so than the fact that the Colmonoy Spraywelder is so low in price that any shop can have one. And the process is so easily executed that anyone can do it.

WRITE for Complete Information

The Colmonoy Spraywelder, combining metallizing and welding, opens up new opportunities for profitable operations.

Write for new literature and full information.

B-7

WALL COLMONOY CORPORATION

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BOYAR-SCHULTZ PROFILE GRINDERS

Fast, Accurate CONTOUR GRINDING

IN THE TOOL ROOM...IN PRODUCTION

Boyar-Schultz Profile Grinders save time in grinding inside and outside contours, irregularly shaped profiles, die clearances and many other difficult grinding tasks.

Boyar-Schultz No. 2 Profile Grinder
A heavy duty floor model available with single or dual spindles which turn at 10,000 R.P.M. with vertical oscillations. Rapid stock removal even with wheels as small as ½" diameter. Uses wheels ½" to 3".

Boyar-Schultz No. 1 Profile Grinder
Bench model. Spindle speed of 20,000 R.P.M. with vertical oscillations. Accommodates wheels ⅛" to 1" diameter. A highly efficient tool that performs in minutes, much of the work that formerly required hours.

Boyar-Schultz CORPORATION

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RED-E-TOOLS

SAVE MONEY . . .
SPEED PRODUCTION . . .
SAFEGUARD PRECISION!

Improved . . . Balanced

CAM ACTION GRINDER DOG

"The dog without a bite"

If you are seeking increased production, this dog can be an important factor. It is easy to adjust, with instant positive holding action...yet may be used safely on precision finished work without danger of marring, because the cam face is ground smooth both as to surface and contour, thus reducing spoilage and rejects.

An excellent dog for all types of grinders and especially for semi-automatic machines, because once adjusted for size, all that is necessary in setting up work is to simply release the cam. The harder the drive, the tighter it grips.

Available in five sizes to take work from ⅛" to 2" diameter. Made entirely of steel with ground finish. Send for Catalog T-47

THE READY TOOL COMPANY
IRANISTAN & R. R. AVENUES
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CEMENTED CARBIDE TIPPED LATHE & GRINDER CENTERS with the RED-E Safety "Life Line"

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RED-E NEW DEPARTURE BALL BEARING CENTERS

RED-E STYLE X LATHE TOOL with the Tool Steel Bearing

MILLING MACHINE & FACE PLATE DOGS

GRINDER DOGS

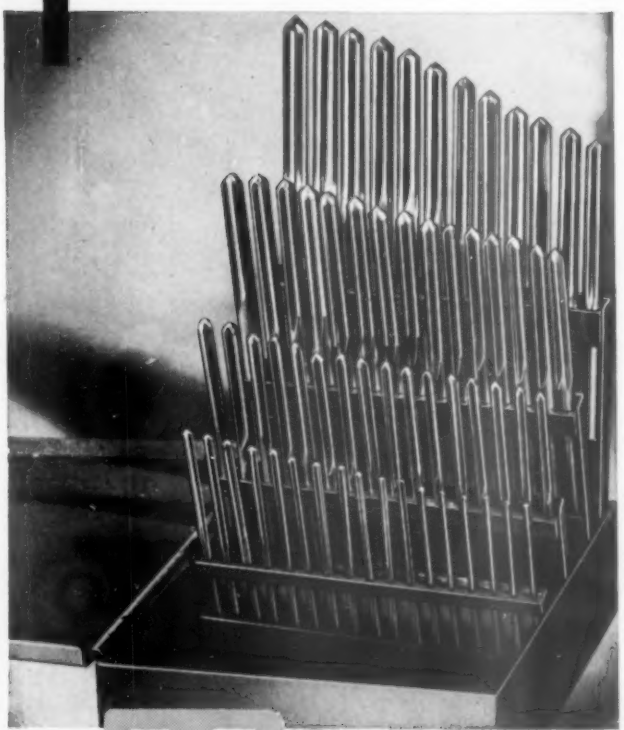
RED-E-TOOLS

Bulletins on any or all of these Products on request.

Specialists

It takes many people and many things to keep an unvarying accent on the accurate dimension control, fine finish and super-hardness inherent in L & I Ground Flute Reamers. Strict adherence to a singularly high purpose such as this places these Wire Gage Sizes in a class apart. Available in complete sets or individual sizes. Your advantage . . . eliminating the delay and added cost of ordering specials.

• There are sixty-nine in-between-sizes of L & I Wire Gage Reamers — from 5/16 down to .040.



L&I *Reamers* GROUND FROM THE SOLID

LAVALLEE and IDE, Inc.
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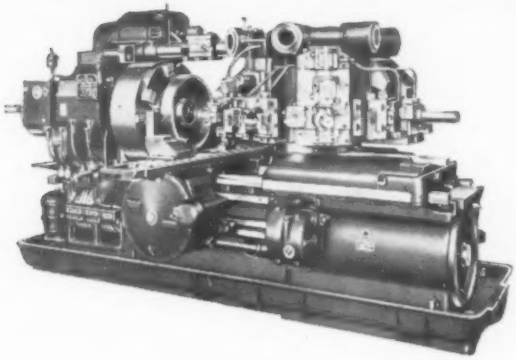
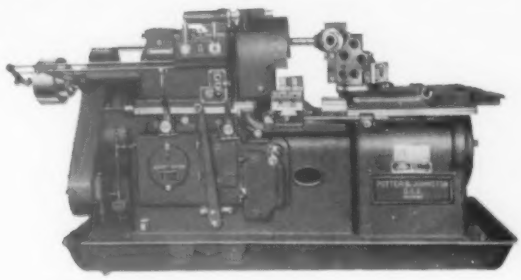
P&J AUTOMATIC CHUCKING *and* TURNING MACHINES

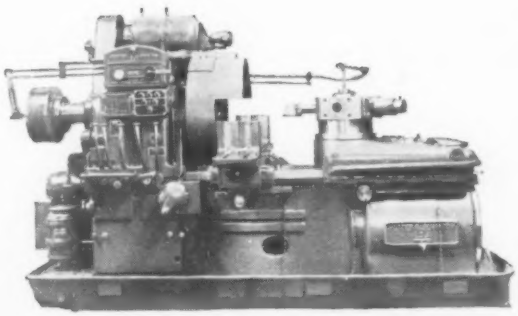
Leaders in their field for more than 40 years



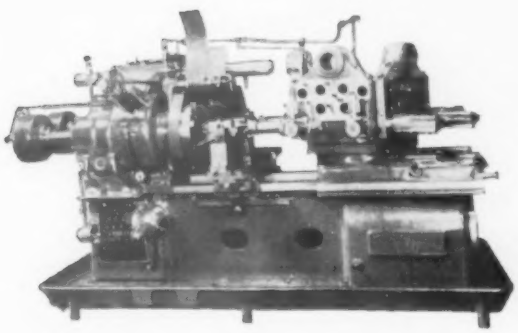
P&J 8DT and 8DXT Automatic



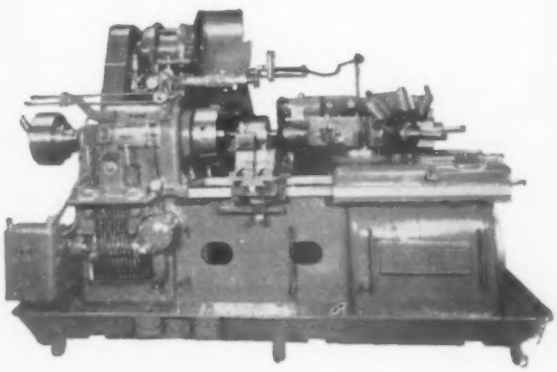
P&J 4D Automatic



P&J 6D REL and 6D REELX Automatic



P&J 5D Two Spindle Power-Flex Automatic



P&J 5D Power-Flex Automatic

BUY THOSE EXTRA
VICTORY BONDS NOW!

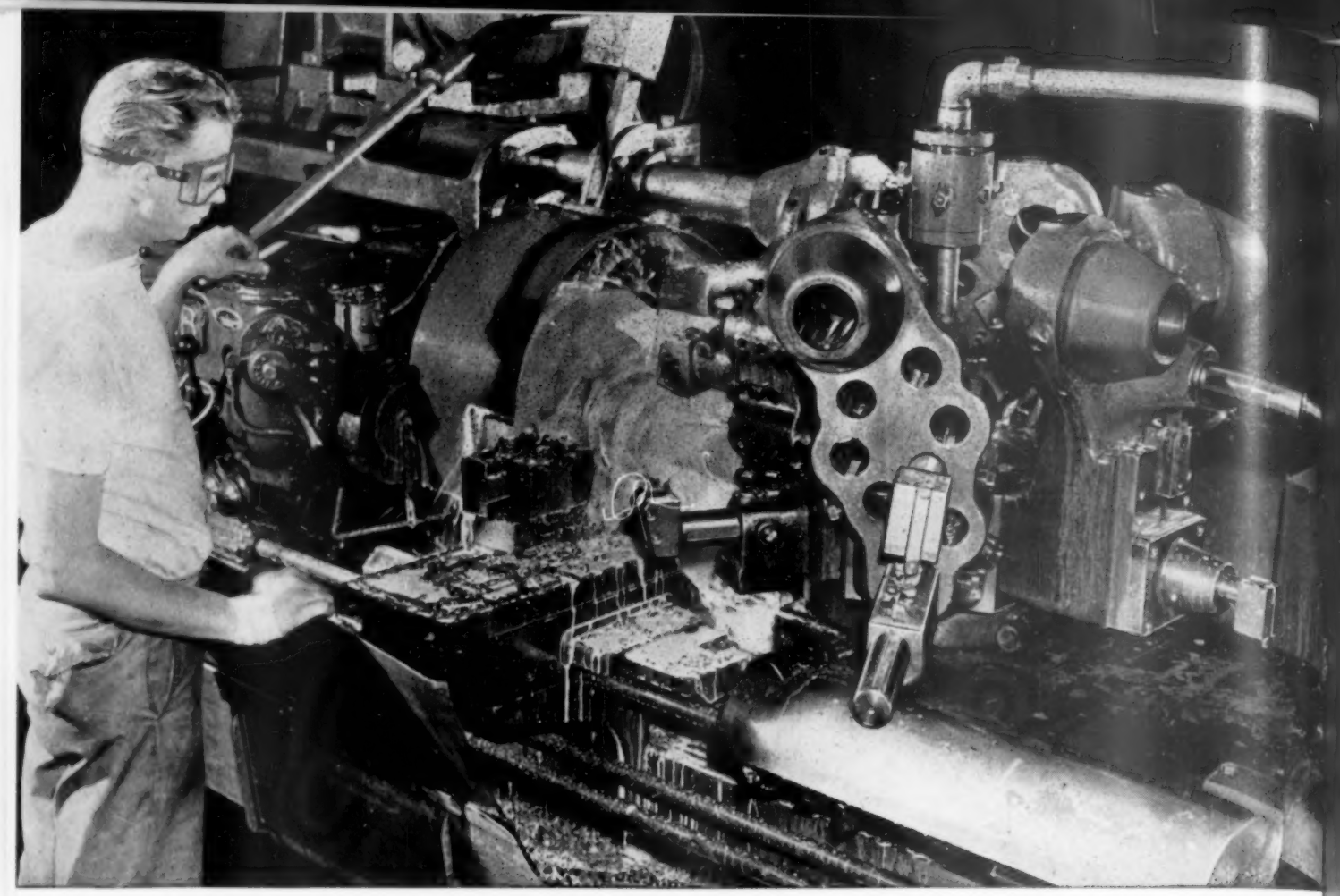
The complete line of P&J Manufacturing Automatic Chucking and Turning Machines covers practically all requirements for size range of work. High accuracy, fast work and convenience in handling are assured whether parts produced are small or large. Every machine regardless of capacity, can be tooled and re-tooled to provide the utmost in flexibility for meeting specific machining requirements.

P&J engineers are available to help you with your production problems. Ask for descriptive literature covering P&J machines.

Authorized Agent, U. S. War Assets Corporation

POTTER & JOHNSTON MACHINE COMPANY

Pawtucket, R. I.



How this FASTERMATIC combined two jobs in one chucking!

Here, on a clutch sleeve, the Fastermatic eliminated an extra chucking and machining operation by the simple addition of a standard automatic recess boring attachment. The work, which previously required two machines and two operators, is now done complete in *one* Fastermatic operation. More concentric diameters are produced through a *single* chucking—and production is increased.

In case after case, the versatility of the Fastermatic together with the tooling "know-how" of Gisholt engineers have made it possible to handle more work with standard tools and attachments, and do it on a cost-cutting basis.

Why not see for yourself what Gisholt's combination of EXPERIENCE and the RIGHT MACHINE can do for you?

GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of leading specialists to help you solve your problems in the machining, surface finishing and balancing of round and semi-round parts. Ask Gisholt for help on your problems.*

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

In the motor laminations operation, metal stamped was .025" silicon rotor steel with highly-abrasive properties—a rugged test for any punch and die set.

40 cookies to 1

Amazing results on stamping motor laminations show Carboloy Cemented Carbide sheet metal dies produce 1,500,000 to 2,000,000 pieces (or cookies) per grind compared with 50,000 pieces for steel dies.

But that's only part of the story. Anticipated die life of Carboloy* punch and die sets is from 40 to 50 million pieces!

In other words, Carboloy* dies are way ahead, 40 to 1! Translate this into production costs, and see how you can be ahead just as much.

Other Big Advantages

In many fields, present users report closer tolerances—fewer rejects—lower cost per piece—minimum burr—big increases in output per press.

Send today for free booklet D-120, packed with ideas on results you can get.

CARBOLOY COMPANY, INC.

11101 E. 8 Mile St., Detroit 32, Mich.

* CARBOLOY (TRADEMARK) CEMENTED CARBIDE

SHEET METAL DRAWING AND BLANKING DIES

SWARTZ STANDARD DRILL JIGS AND FIXTURE LOCKS

AN APPLICATION SHOWING MERITS OF THE LS TYPE FIXTURE. ROUND PARTS CAN BE HELD AGAINST HEAVY DRILL TORQUE BY MAKING DRILL PRESSURE HELP THE CLAMPING. STEEL INSERTS SET ON ANGLE GRIP PARTS; WHILE TOP PLATE AUTOMATICALLY FOLLOWS UP ANY LOWERING OF THE WORK.

ASK FOR CATALOG 941

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley Avenue — Detroit 27, Michigan

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Indianapolis—J. W. Mull, Jr.
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Boston—A. R. Shevlin Co.
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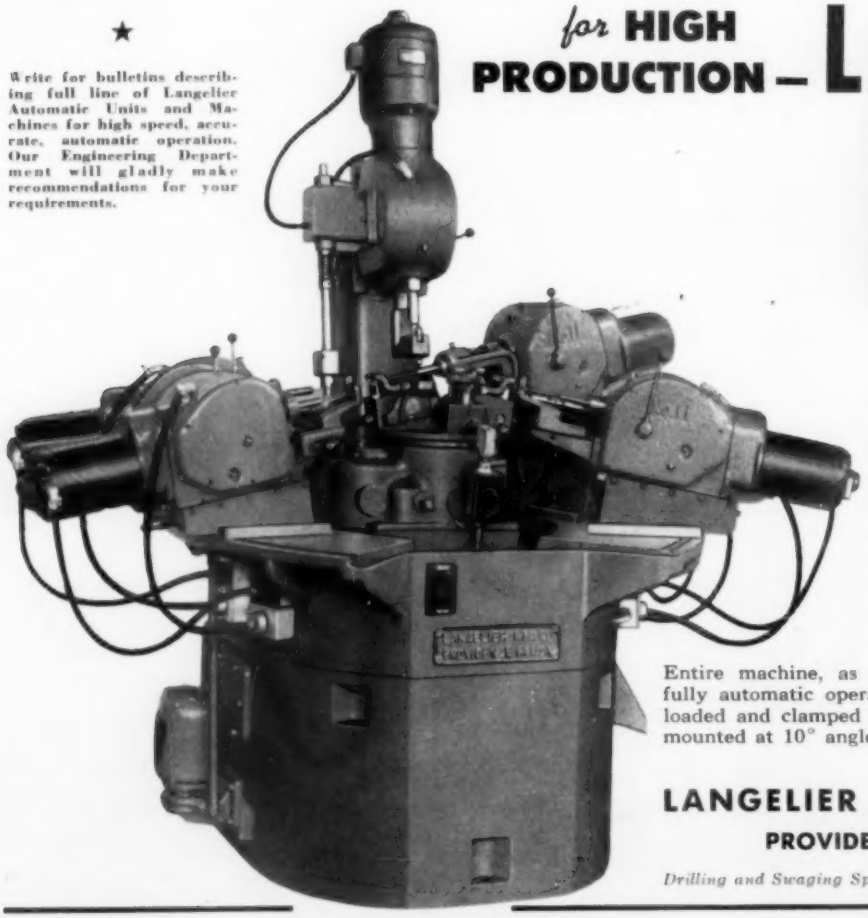
★

Write for bulletins describing full line of Langelier Automatic Units and Machines for high speed, accurate, automatic operation. Our Engineering Department will gladly make recommendations for your requirements.

for HIGH PRODUCTION — LANGELIER

AUTOMATIC UNITS *for* MULTIPLE DRILLING TAPPING ETC.

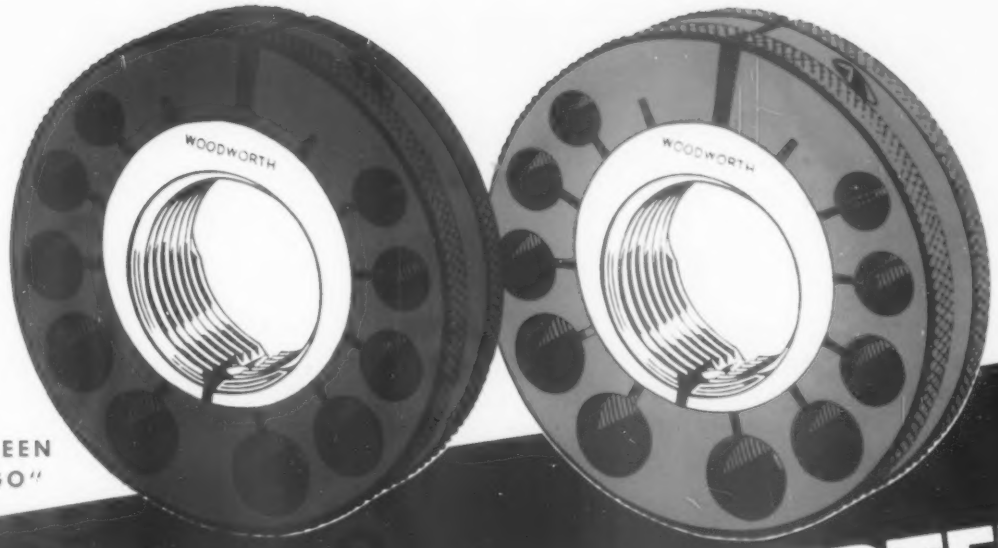


Speed and efficiency are contributed to multi-operation production by LANGELIER Automatic Units arranged in various combinations. Typical is the Special Machine at left, which handles drilling, grooving, tapping and counterboring operations by means of five Langelier Drilling Units and one Tapping Unit. (Also available: milling, reaming, spotting, chamfering, etc.) Multiple Spindle attachable Langelier heads may be mounted on feed sleeves of each Unit for combinations of these operations. Entire machine, as illustrated, is electrically interlocked for fully automatic operation and central control. Work manually loaded and clamped in fixtures on 4-station dial. Note fixtures mounted at 10° angle to permit drilling into rear of work.

LANGELIER MANUFACTURING CO.

PROVIDENCE • RHODE ISLAND

Drilling and Swaging Specialists for Over 50 Years . . . Incorporated 1887



RED
"NOT GO"
Pat. Pending

GREEN
"GO"

NEW TESTED-ACCEPTED THREAD RING GAGES

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH RING GAGES STILL PROVING "ON THE JOB" SUPREMACY OVER ORDINARY GAGES

No wonder more and more industries are adopting this gage as standard. Its revolutionary design assures wear life 5 to 7 times longer. And maintains accurate inspection.

This *proved* gage is easy to adjust, light in weight, durable—it's a *must* for cutting costs, increasing production. Just try the Woodworth Thread Ring Gage on your extra tough job—and you, too, will standardize!

Wire or write for folder No. 46R at no obligation.

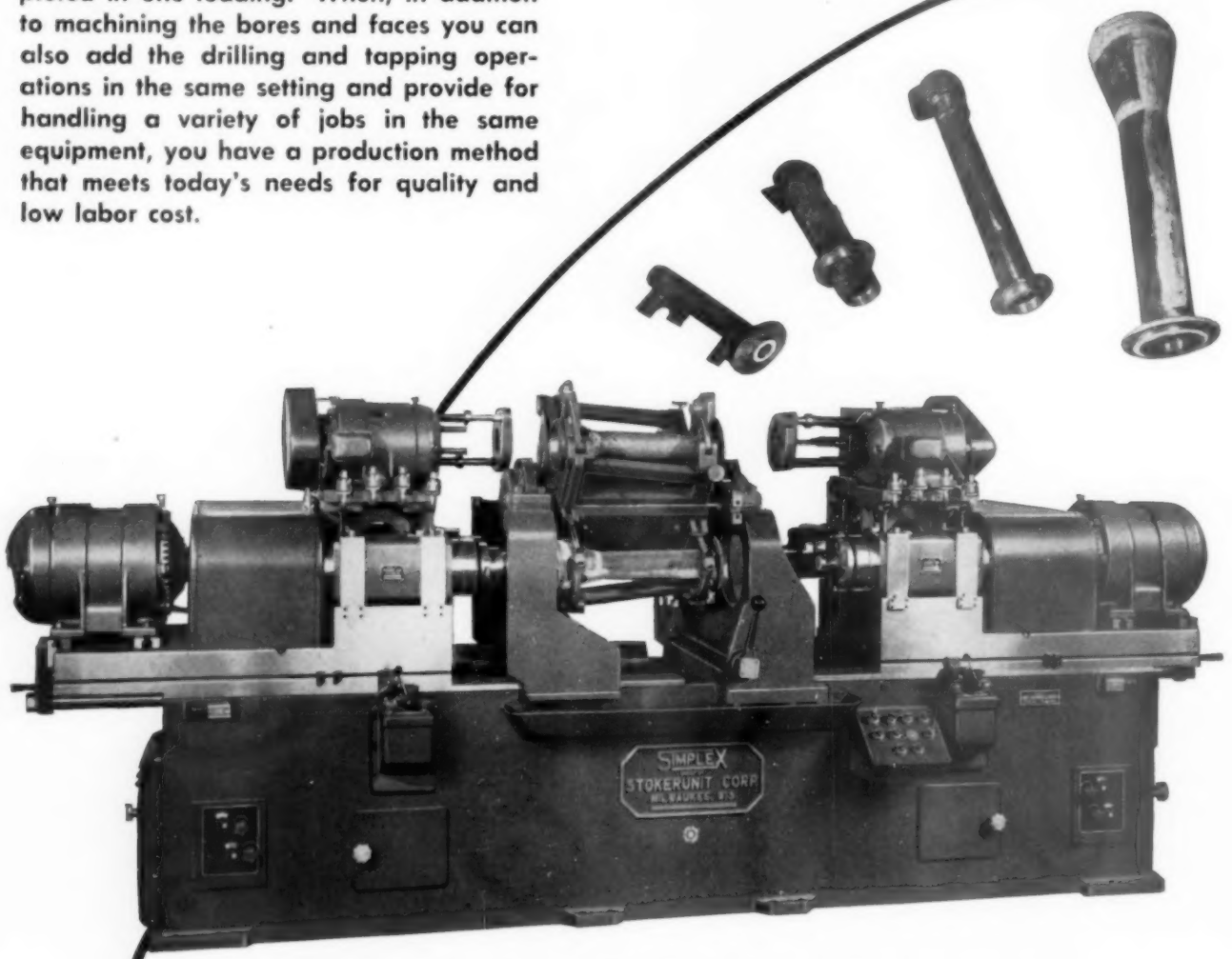
WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

SIMPLEX

Machining tubular parts where the bores must be concentric, the faces parallel, is a difficult job unless the work can be completed in one loading. When, in addition to machining the bores and faces you can also add the drilling and tapping operations in the same setting and provide for handling a variety of jobs in the same equipment, you have a production method that meets today's needs for quality and low labor cost.



The machine pictured is a SIMPLEX 4U 2-way Precision Boring Machine with four #4 spindles mounting combination boring and facing heads and also carrying unit type drilling heads with bushing plates for the drilling operation. By changing the fixtures, drills and boring tools, the various pieces illustrated can be handled with the same machine, thus this machine becomes in effect a production department in itself.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

Comparison PROVES its superiority!

Improved TECO Cemented Carbide *gives*

- more pieces between grinds
- more grinds per tool
- less down time
- lower tool cost

TYPICAL CASE

Part: Locomotive Driving Wheel (Cast Steel)
Machine: Betts 100″ Vertical Lathe
Operation: Turning outside diameter
Diameter: 53⅞″
Width: 5½″
Depth of cut: ⅛″ to ⅜″
Feed: .055″
Speed: 175 ft.
Pieces per Grind: 14 wheels*
Previous carbide production: 1 to 2 wheels
*Castings are exceptionally rough and irregular resulting in interrupted cut at the start.

WITH rare exception, every plant that has tried Improved TECO Cemented Carbide reports carbide performance beyond anything they have ever experienced. This is to be expected of Improved TECO, which combines hardness, toughness and uniformity to a degree never before obtained in a cutting material. It has far greater resistance to wear and breakage in severe service.

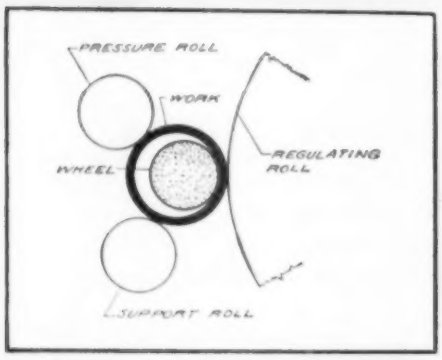
Make your own comparison! Tool up any carbide job with Improved TECO Cemented Carbide. Then compare results with your present production . . . for pieces per grind, grinds per tool, tool life, tool cost. Check, too, TECO's exceptional ability to operate at increased speeds and feeds.

Send details of your job set-up, or call one of our tool engineers for a discussion. Latest catalog and price list sent on request.

Improved
TECO
CEMENTED CARBIDE

TUNGSTEN ELECTRIC CORPORATION
570 39th STREET, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

. . . when it comes to low-cost CENTERLESS internal grinding



This sketch illustrates the chuck-less method of Heald Centerless grinding, in which three rolls locate and rotate the work on its own outside diameter. Ground bore is actually generated from the O.D. Result: simplified grinding, perfect concentricity, lower costs.

EACH ONE of the four different Heald Centerless Internals is designed to grind a particular range of work. All together, they cover every centerless internal grinding requirement—handling work all the way up to 26" O.D. by 16" long.

You'll find that the unique Heald method of Centerless grinding can cut your costs and improve quality in a number of ways. For instance, it assures perfect concentricity between ground bore and O.D. . . . gives fast, easy loading, completely automatic on the No. 81 . . . provides automatic sizing controls when required . . . permits accurate relocation of work for checking or reversal . . . eliminates work holding fixtures . . . and often allows one operator to handle several machines.

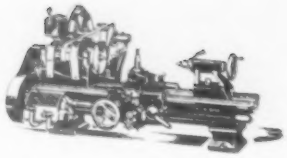
For further information on Heald Centerless grinding, and how one of these machines can be applied in your own work, get in touch with the Heald branch office nearest you. Or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

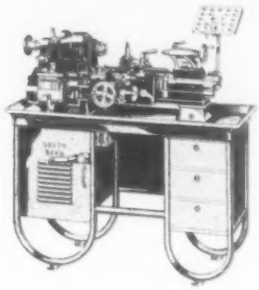
means more precision
. . . less cost

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

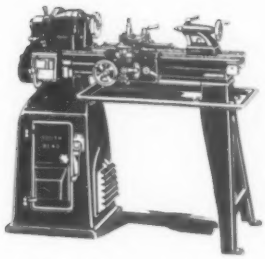
INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES



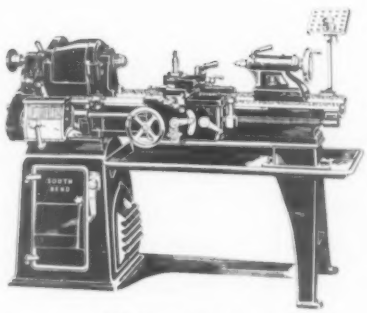
9" Bench Lathe



10" Bench Lathe

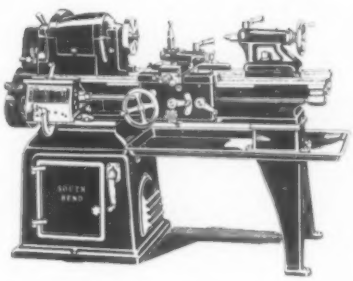


10" Engine Lathe

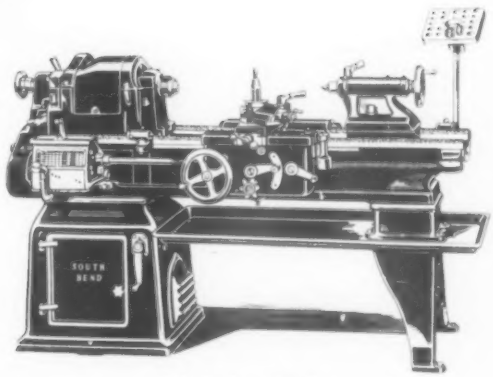


13" Toolroom Lathe

SOUTH BEND LATHES for accurate production operations and exacting toolroom work. Engine Lathes and Toolroom Lathes with 9", 10", 13", 14½", and 16" swings. Precision Turret Lathes with ½" and 1" collet capacities. Write for Catalog 100-F.



14½" Engine Lathe



16" Toolroom Lathe

SOUTH BEND LATHE WORKS

LATHE BUILDERS SINCE 1906 • 531 EAST MADISON STREET, SOUTH BEND 22, INDIANA

INCREASE *Production*...
DECREASE UNNECESSARY HEADACHES BY ORDERING
CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES

The most efficient tools are brazed with carbide tips on hardened high-speed steel bodies, so that the total length of the flutes and pilots Rockwell C-62-63.

It has also been proven in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less spring back under heavy cuts for this same reason. Also, the flutes and pilots will not score or pick-up due to the hardness of the high-speed steel and long wear on the pilot.

If you have a cutting tool problem, DETROIT REAMER & TOOL COMPANY would appreciate an opportunity to work it out with you.

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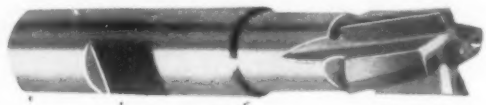
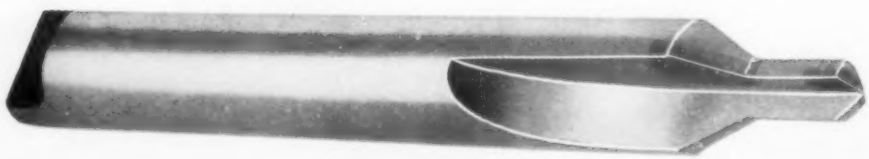
• MADE TO YOUR SPECIFICATIONS •

DETROIT REAMER & TOOL CO.

2830 E. Seven Mile Road — Detroit 12, Michigan

Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools





SUBLAND REAMERS
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CENTER DRILLS
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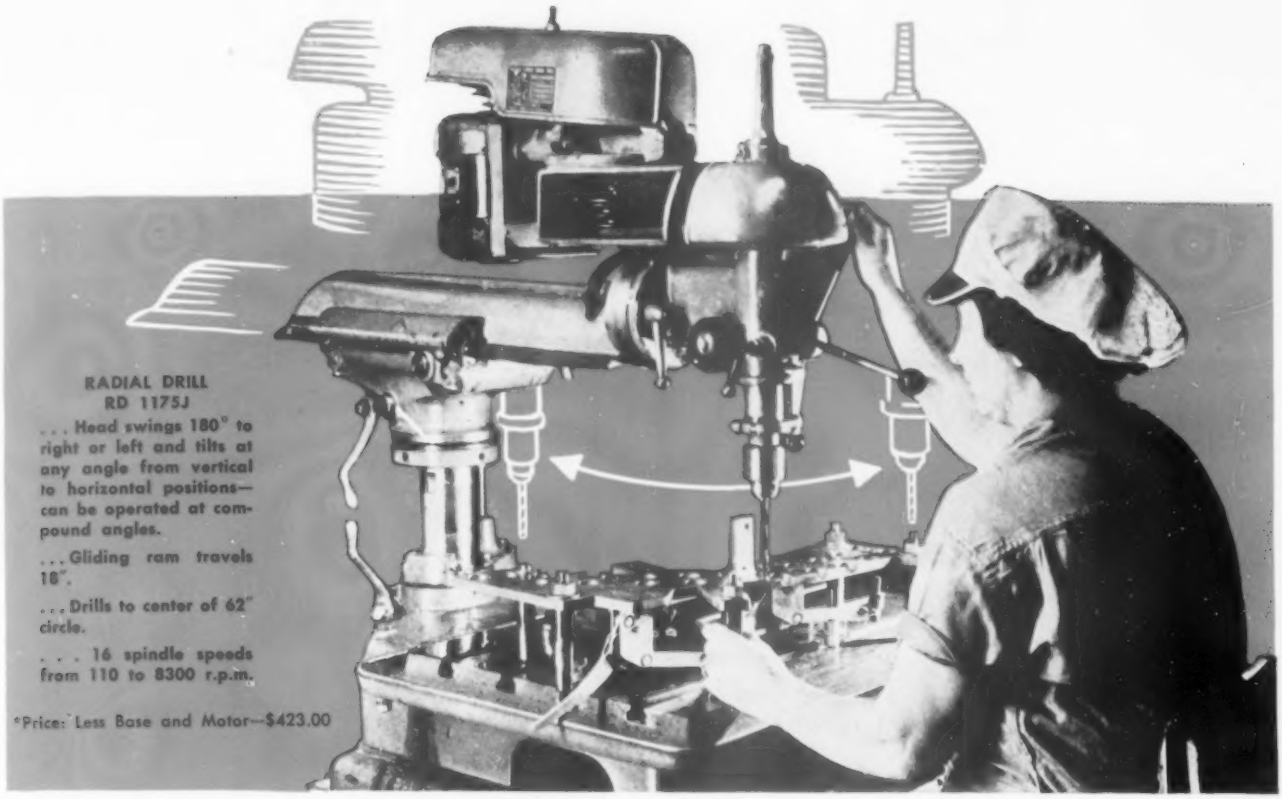
Special Tools To Your Specifications



RADIAL DRILL
RD 1175J

. . . Head swings 180° to right or left and tilts at any angle from vertical to horizontal positions—can be operated at compound angles.

. . . Gliding ram travels 18".

. . . Drills to center of 62" circle.

. . . 16 spindle speeds from 110 to 8300 r.p.m.

*Price: Less Base and Motor—$423.00

WHERE THE EASIEST WAY IS BEST

14" METAL CUTTING BAND SAWS—MBN935

Speeds: 61 to 4630 s.f.m., Table tilts 45° — Equipped with mitre gauge grooves—*Price: Less base and motor—**$153.00**

15" DRILL PRESS BENCH MODEL—D950

Spindle travel 4¼" — Standard spindle speeds: 600 to 5000 r.p.m.—*Price: Less motor and belt guard—**$56.25**

This Radial Drill is typical of a family of Walker-Turner metal working machines that are safe, fast and easy to learn to operate. It's the easiest way to meet everchanging production specifications with lowest overhead and operating costs.

The operator moves the drill to the work—many times on the piece shown. Full vision, easy manipulation—and speed without fatigue —all day long.

A study of the specifications indicates how well it will do your present work and how quickly it can be adapted to a new product or a new material.

Walker-Turner Machines are also the easy way to reduce overhead costs. By increasing production, they write off their low first cost in a few months—wherever metals, wood or plastics are drilled, cut or shaped. The Walker-Turner General Catalog will be sent on request. 22

*F.O.B. Plainfield—slightly higher west of the Rockies and in Canada

SOLD ONLY BY AUTHORIZED INDUSTRIAL MACHINERY DISTRIBUTORS

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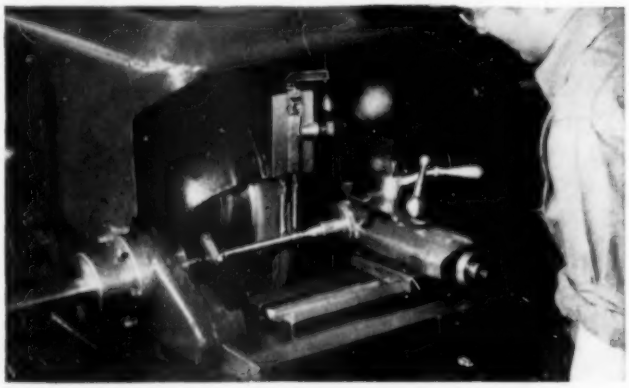
MACHINE TOOLS

DRILL PRESSES—HAND AND POWER FEED • RADIAL DRILLS • RADIAL SAWS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

3 point service



for better precision grinding!

The use of straight oils for precision, production grinding is resulting in spectacular improvements in finish, and making it possible to grind within tolerances never before thought practicable. If you want better grinding, it will pay you to investigate the Stuart line of grinding oils.

To improve metal-working efficiency, take advantage of Stuart 3-point service:

1 ***The right oil for the job*** . . . every oil in the complete Stuart line is formulated for a specific purpose. Whatever the job, there is a Stuart oil to handle it best.

2 ***Sound engineering*** . . . Stuart engineers and laboratory technicians are neither textbook theorists nor self-taught handymen. They are practical oil men thoroughly schooled in their profession by study and first-hand experience.

ThredKut 99
. . . for grinding tough, stringy metals . . . makes grinding wheels *"act harder."*

SUPERKOOL 81X
. . . for precision grinding on metals in middle range of grinding hardness.

EXCELENE
. . . for grinding hard steels . . . makes grinding wheels *"act softer."*

3 ***Intelligent, specialized service...*** Stuart representatives have an intimate knowledge of metal-working oil requirements, and of the advantages of each Stuart oil. They will study your oil problems and help you solve them. For further information, write for "Grinding With Oil," a 12-page booklet.

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STUART *service goes with every barrel*

Because . . . . .

DRILL JIG BUSHINGS
AND
GAGES

are production tools, and because your . . . .

TOOLS E PRECISION MADE

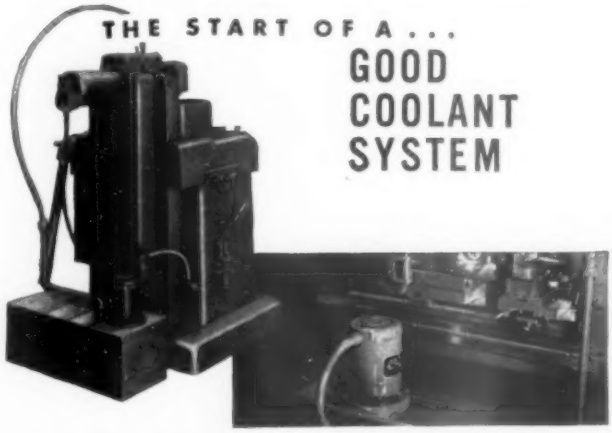
Production
Depends on
Qualified service,

. . . . both items have been made available for prompt delivery.

Write today for particulars

ECONOMY TOOL & MACHINE CO.
MILWAUKEE 14, WISC., U.S.A.

THE START OF A . . .
GOOD COOLANT SYSTEM



Photos Courtesy
The Taft-Peirce Mfg. Co.
Woonsocket, R. I.
Hardinge Bros., Inc.
Elmira, N. Y.

RUTHMAN GUSHER COOLANT PUMPS

The efficiency of any coolant system depends entirely on the efficiency of the Pump that controls it. Here Ruthman Gusher Coolant Pumps are outstanding. Split second coolant control, long trouble-free life, and vibrationless rigidity are among the outstanding qualities that have made Gusher Pumps preferred by the leading machine tool manufacturers.

Illustrated above left is a *Model 1-P3 Long Gusher Coolant Pump on a Taft Peirce No. 6 Rotary Surface Grinder.* To the right is a *Model 1-P3 Short Gusher Coolant Pump on a Hardinge DSM59 H.S. Precision Second Operation Machine.*

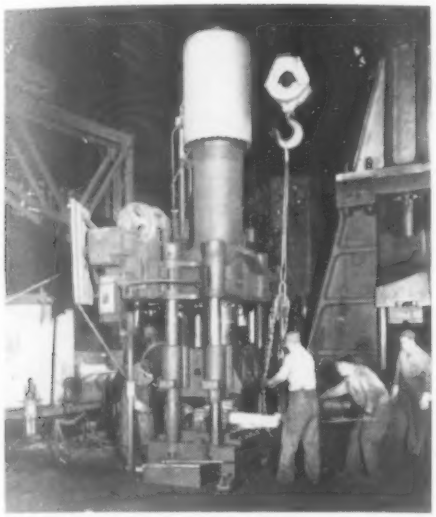
Write for Catalog 10-I

Model TL 7320

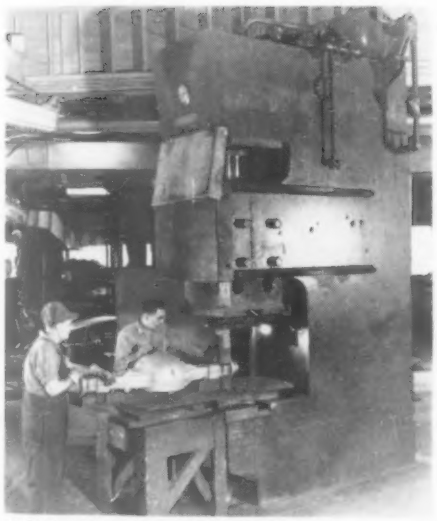
THE RUTHMAN MACHINERY CO.
1810 Reading Road Cincinnati, Ohio

Hot or Cold...

IT MAKES NO DIFFERENCE



HOT—This 400 ton, 4 column, self-contained Farquhar Hydraulic Press is used in the shipbuilding industry for trimming and forging hot metal.



COLD—This 200 ton self-aligned gap type Farquhar Hydraulic Press is used by the Albion Malleable Iron Co. for cold shearing of gates from miscellaneous automotive castings weighing up to 300 lbs.

Farquhar HYDRAULIC PRESSES

SAVE
- TIME
- MONEY
- LABOR

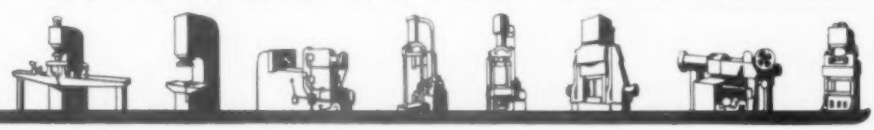
In the metal working field, no matter what the job—hot or cold—there's a Farquhar Hydraulic Press to save time, labor and money.

You save with Farquhar Hydraulic Presses because they are designed to do a job quickly (fast advance and return of ram), accurately (machined for precision work), efficiently (no wasted power).

Consult our experienced Engineers . . . There's a speedy, accurate, efficient Farquhar Hydraulic Press for your exact requirements.

WRITE TODAY . . . ask for a copy of the new 1947 Farquhar Hydraulic Press Catalog.

HYDRAULIC PRODUCTION PRESSES
MATERIAL HANDLING CONVEYORS • SPECIAL MACHINERY

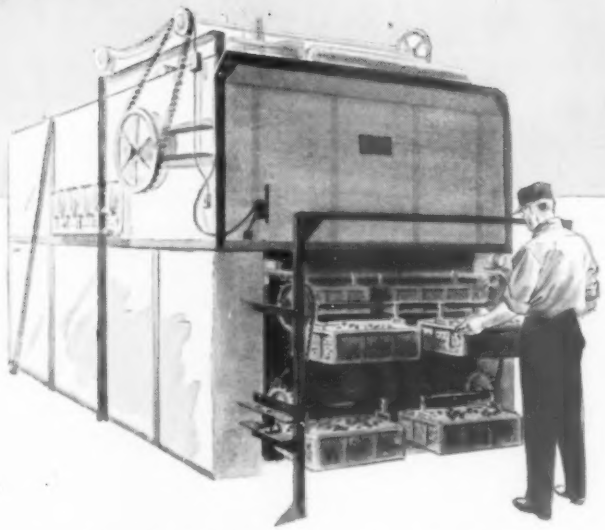


Farquhar
HYDRAULIC PRESS DIVISION

A. B. FARQUHAR COMPANY
1519 DUKE STREET, YORK, PENNSYLVANIA

WAA OFFERS AT LOW COST

Industrial Ovens



Baking and drying ovens, of specifications, sizes and types in common use but which today are not readily available, can now be purchased for prompt delivery from the War Assets Administration. Regardless of your specialized requirements, the odds are in favor of your needs being satisfied from this extensive surplus stock. Prices are so low that ovens may be converted from their original use when this is desirable and still permit a substantial saving to the purchaser.

There are ovens for the following uses: for baking lacquer, enamel, synthetic resin, japanning, for low temperature metal heat treating, for drying and curing chemicals, rubber, paper, lithographing, plastics, ceramics, etc.

Principal inventories are located at: Boston, Chicago, Cincinnati, Cleveland, Minneapolis, New York, Philadelphia, Richmond, St. Louis. Write the above Regional Offices requesting that your name be placed on their mailing lists for this type of surplus.

All furnaces offered subject to prior sale.

ALL FURNACES are sold under existing priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area, and then to purchase the materials offered herein.

EXPORTERS: Your business is solicited. If sales are conducted at various levels, you will be considered as a wholesaler. Any inquiries regarding export control should be referred to Office of International Trade, Department of Commerce, Washington, D. C.

See our display booth

at Western Metal Exposition and Congress Show

at Oakland, California, March 22 to 27, 1947.

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838-3

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Machining Maxel Forged Steel Piston

285-300 Brinell Hardness

5 16 in. Depth of Cut. .019 in. Feed. 325 F.P.M.

No. 5 Warner & Swasey Turret Lathe

New OK insert carbide tipped tool bits and holders

GIVE AN **Amazing** PERFORMANCE

IT IS 12 o'clock noon when we are ready to shoot this picture at the New Haven Vibrator Company. Instead of grabbing lunch, the boys (old timers and recently returned GI's) watched the show with wide-eyed amazement. Never before had this shop seen so much metal removed in so little time. An insert with a carbide tip the size of your thumb nail zipped a cut 5/16 in. deep at the rate of 325 feet per minute. The work piece is a Maxel forged steel piston, 285-300 Brinell hardness, for a foundry vibrating machine. It is finished with a very fine smooth surface and each piece is machined in about one-sixth the customary time.

These new OK Carbide Tipped Tool Bits and Holders have the famous OK locking principle. Mated serrations provide for advancement to compensate for wear and furnish solid support to prevent vibration.

LOW COST. Every shop now can increase the earning power of lathes, etc. and gain the advantages of the super speed of OK tools. These Holders, Series 400, come ⅝, ¾, 1, 1¼ and 1½ inches square and in standard lengths. Interchangeable insert tool bits with carbide tips come ready for immediate use for Turning, Boring, and Facing, and for right and left hand for machining every material. The Holder illustrated is 1¼ inches square, price $3.94. In quantities of fifty, tool bits are priced as low as $3.45.

Send today for one of these 400 Series tools bits and holders. We require the following information: Characteristics of the material to be machined; make and model of machine; size of holder machine will take; horse power available; the operation (turning, boring, or facing) and right- or left-hand.

An OK Tool field engineer will be glad to demonstrate the features of these new tools on your own machines.

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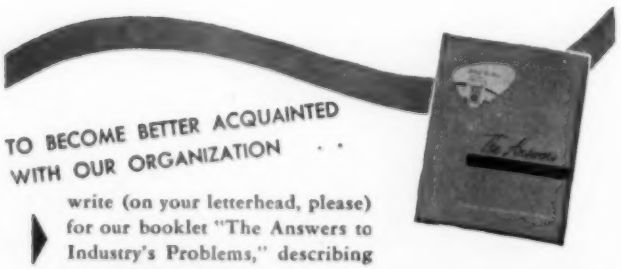

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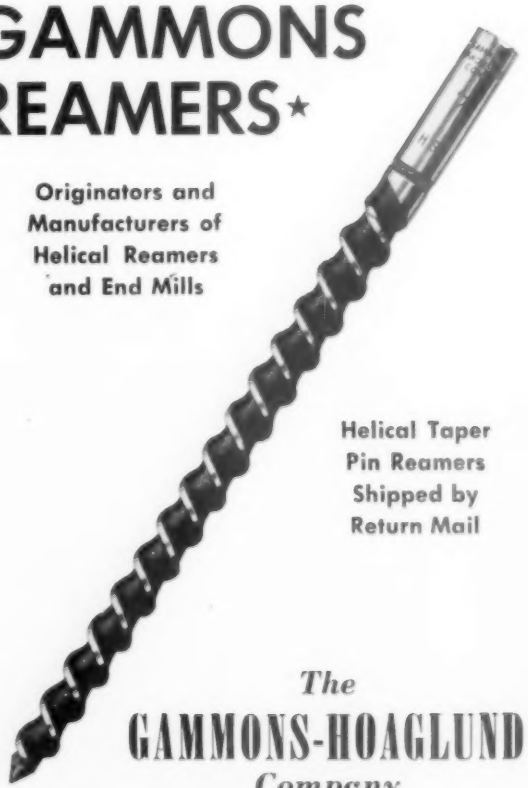

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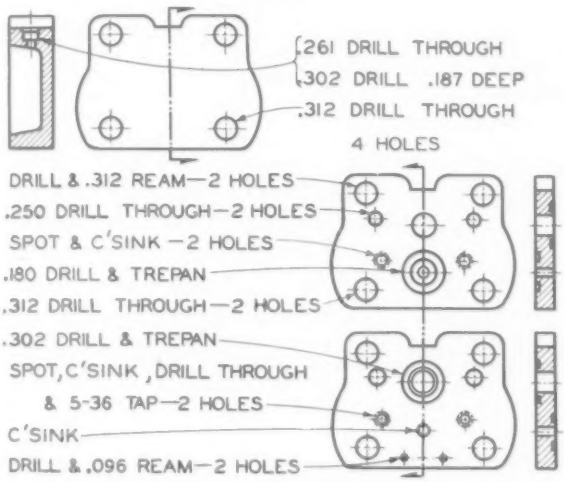
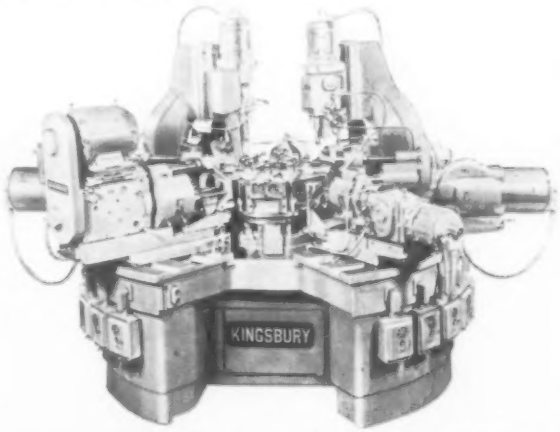
Multiple Drilling for High Production

Problem Machine cast iron cylinder heads (left) and opposite faces of valve plates (right)

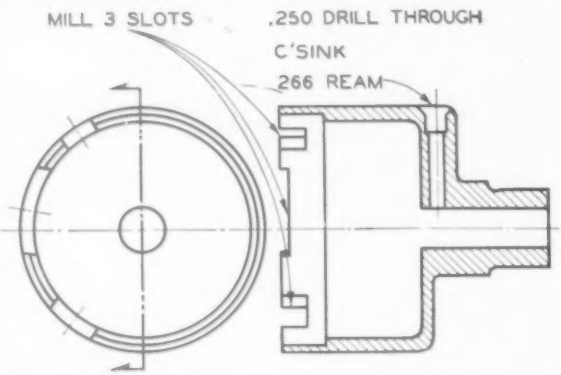


Method ONE 27 SPINDLE AUTOMATIC indexing machine with eight duplicate fixtures performs the operations on either part. Each valve plate is completed in two chuckings. Accuracy is insured by locating the plate in the second chucking from holes reamed in the first.

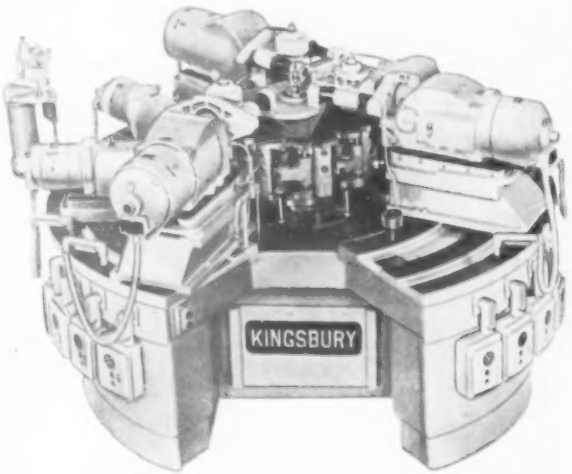


Results 400 PIECES PER HOUR GROSS with one operator, economies in handling, floor space and quality control. These savings reduce the unit cost enough to pay for the machine in a short time.

Problem Machine cast iron distributor bases as shown



Method MILLING AND DRILLING OPERATIONS are combined on this seven-spindle automatic indexing machine. Three of the seven standard drilling units have standard milling attachments. The long hole is drilled in three steps to reduce the time cycle.



Results 480 PIECES PER HOUR GROSS with one operator

If you have high production work involving multiple drilling operations requiring up to 5 H. P. each, we can design, build and tool automatic machinery to solve your problems. Send us your prints showing the operations and hourly production and ask for proposals.

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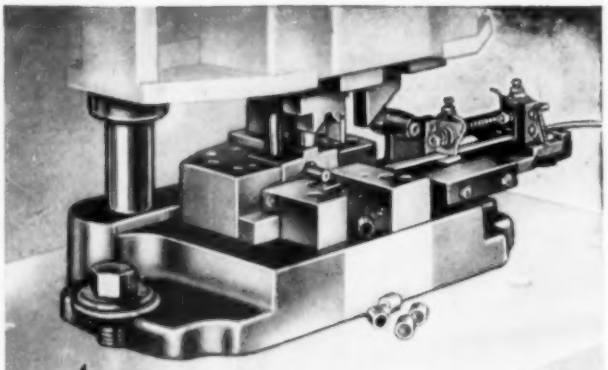

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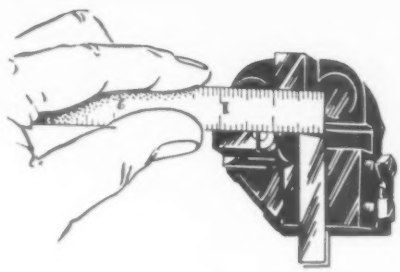

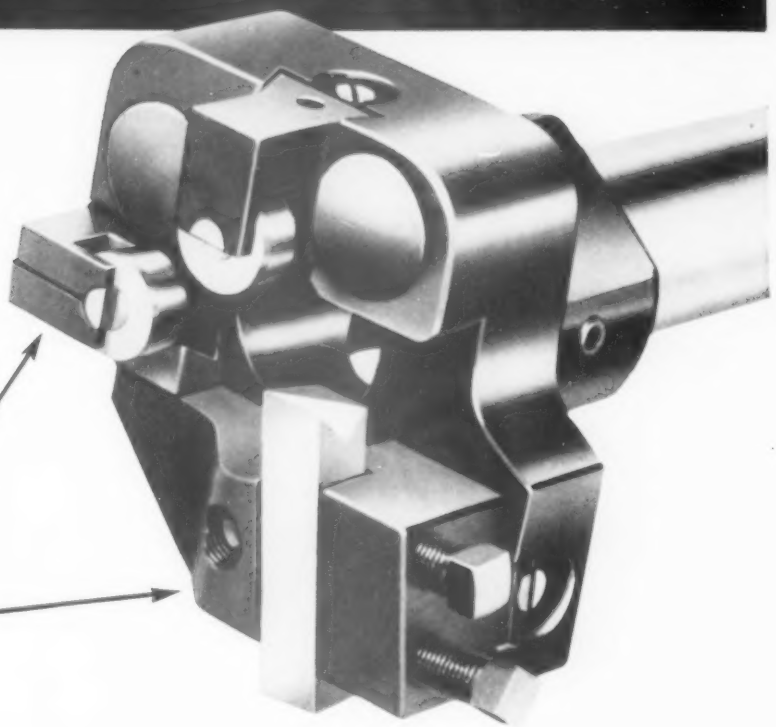

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Straight-edge placed on milled step of left roller block marks correct center line position for cutting land edge of tool bit.

Tool steel can be removed from tool bit holder, sharpened and returned to holder in the correct position with a minimum of down time.

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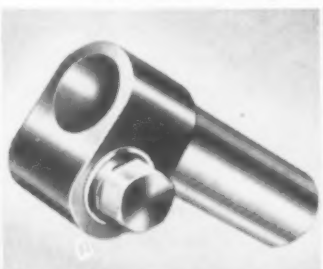

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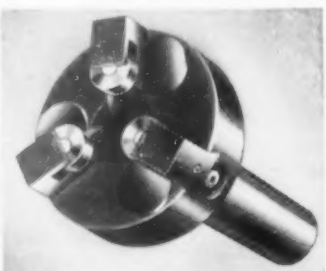

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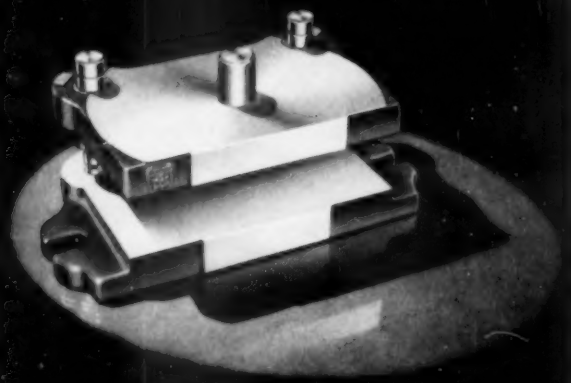

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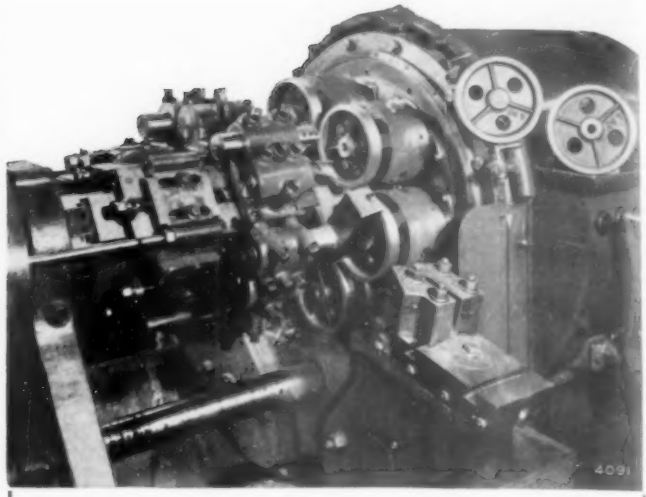

GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

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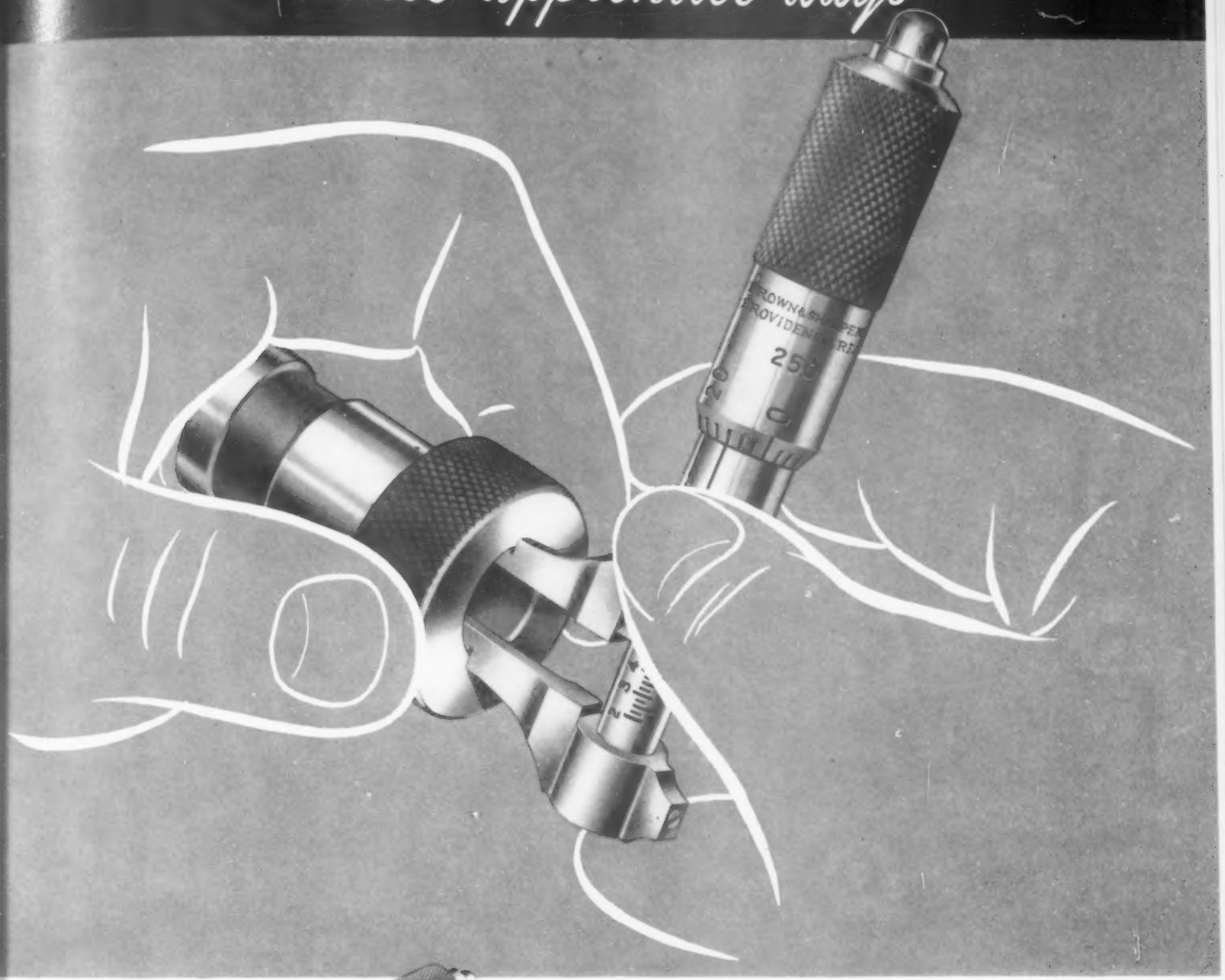
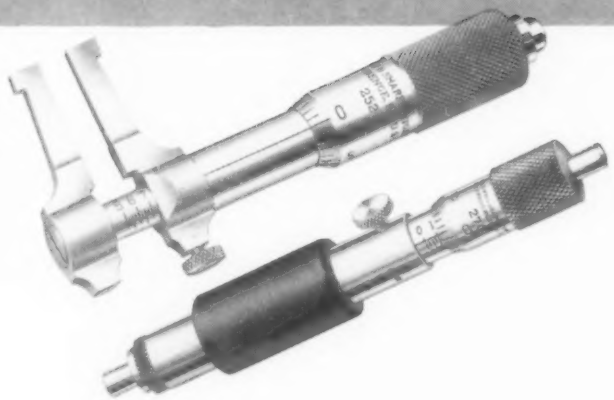
PRIDE OF THE MACHINIST

since apprentice days





Inside Micrometers, Nos. 252 and 270, shown above, are a part of the wide line of Brown & Sharpe Machinists' Tools which include rules, combination squares, bevel protractors, straight edges, vernier tools, dial test indicators and many others.

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We urge buying through the Distributor

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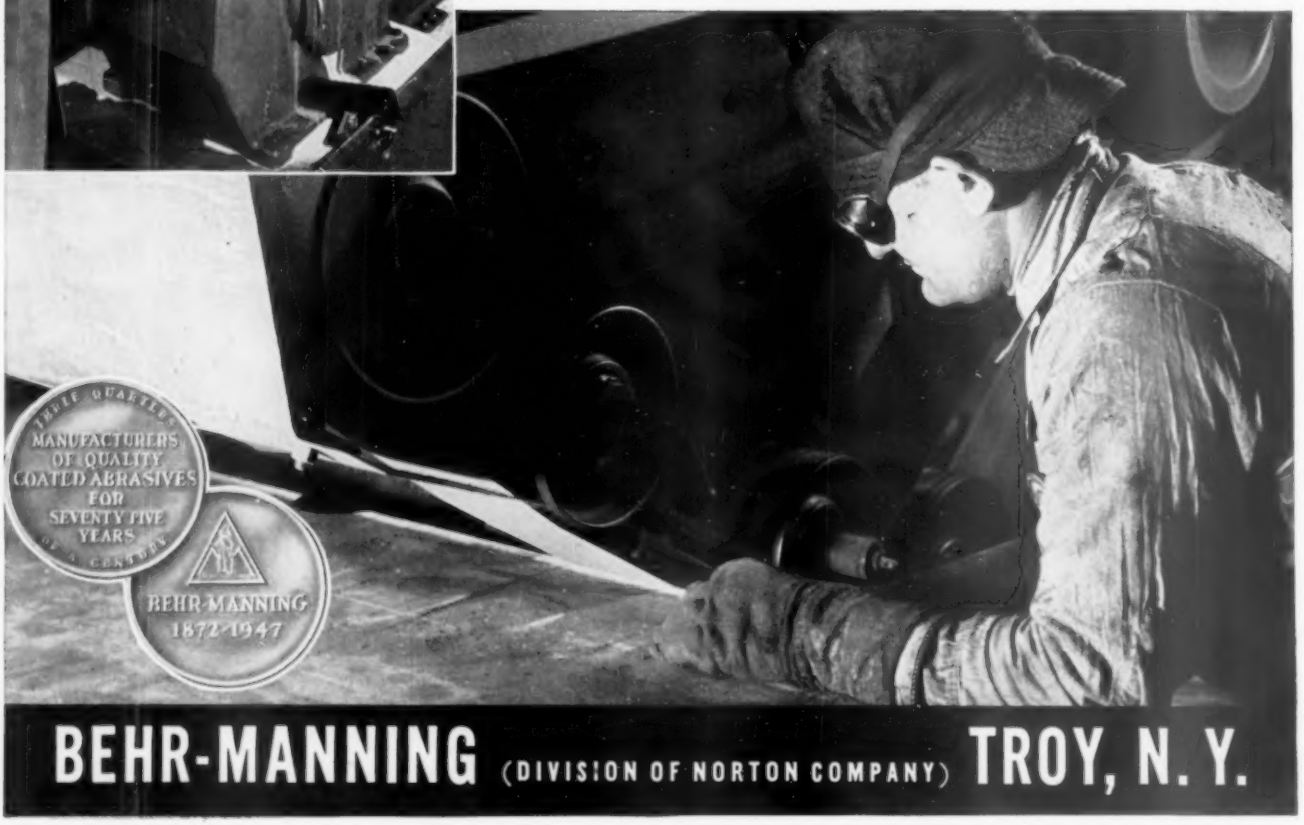
*Reg. U. S. Patent Off.



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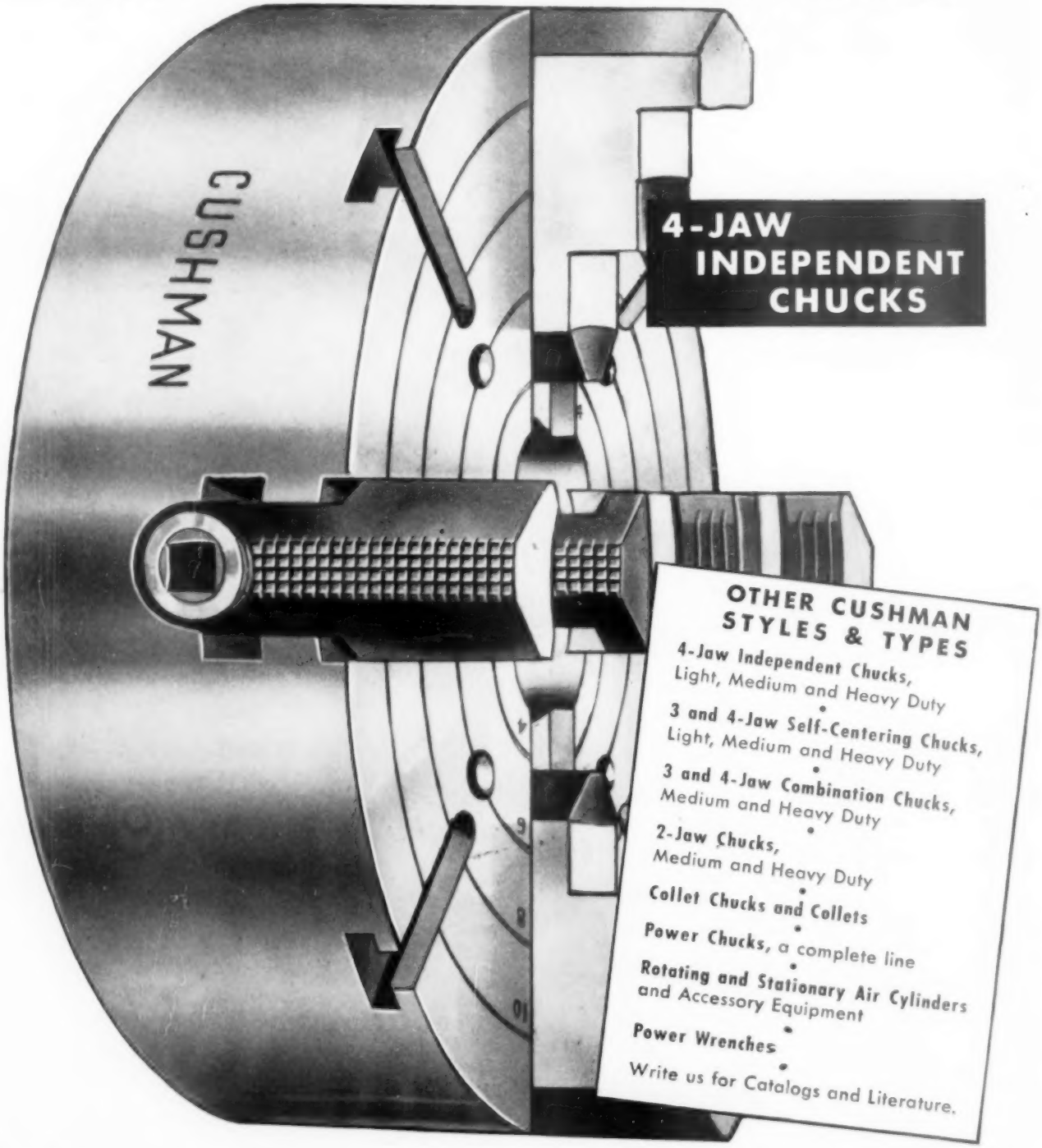

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Gairing Standard type C COUNTERBORE with Interchangeable Cutter and Pilot
Gairing Standard Block-Type BORING BAR showing "quick-change" Cutter Block

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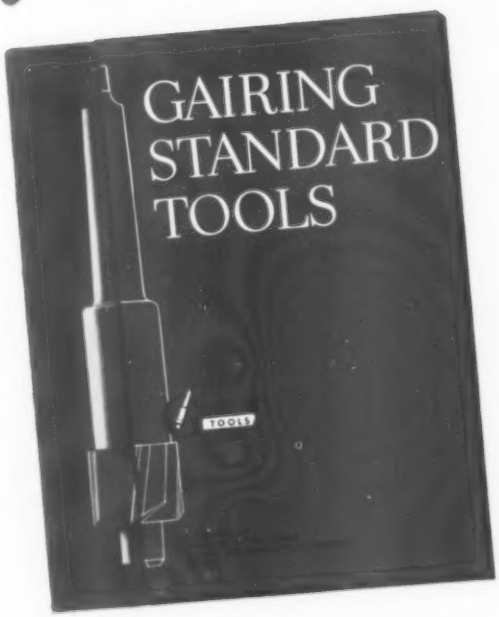

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30th

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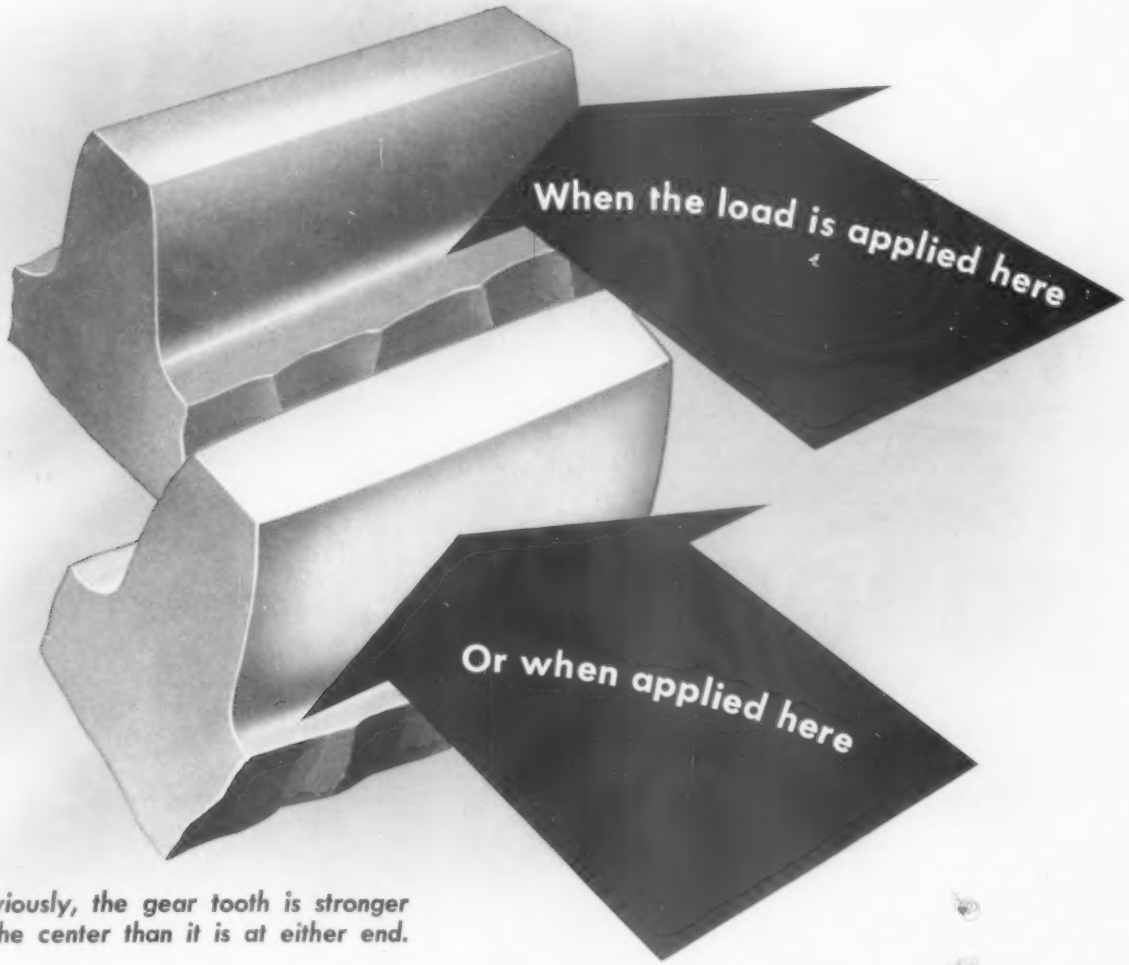
WHERE IS A CRITICALLY LOADED GEAR TOOTH MOST APT TO BREAK?



Obviously, the gear tooth is stronger at the center than it is at either end.

Therefore, only when loads are confined to the central tooth section and avoided at the tooth ends is maximum tooth strength developed.

That is precisely what is accomplished when gear teeth are given the Elliptoid form. The amount of crown need be very little. From .0003″ to .0005″ per inch of tooth face is sufficient to centralize the loads and protect the gear.

Elliptoid teeth are produced on Red Ring Gear Shaving Machines for both spur and helical gears up to 36″ pitch dia.

Ask Red Ring Engineers for performance data on gears of this type.

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The most advanced tapping attachment . . . in design . . . in trouble-free performance . . . in ease of operation. It is ultra sensitive . . . produces high quality threads . . . operates without pressure on the tap . . . produces more tapped holes per hour . . . saves taps. The JARVIS TORQOMATIC is the most efficient tapping attachment developed to date and is, therefore, the most economical.

Ask for the well-illustrated, fully descriptive folder on JARVIS TORQOMATICS. It shows you how to increase quality production at lower cost. WRITE TODAY, Dept. 222, Jarvis Power Tools, Middletown, Connecticut.

The CHARLES L. JARVIS Co.

MIDDLETOWN, CONNECTICUT

TAPPING ATTACHMENTS • FLEXIBLE SHAFTS AND MACHINES
GROUND ROTARY FILES • QUICK CHANGE CHUCKS AND COLLETS

A BUYING GUIDE FOR ABRASIVES

POINT No. 2

INFORMATIVE LITERATURE

Being so closely identified with the development and progress of abrasives, it is natural that The Carborundum Company should be the source of so much authoritative literature on their application, care, and handling. Certain highly successful concerns regard the helpful service of technical and engineering literature supplied by The Carborundum Company as a significant point in their preference for abrasives by CARBORUNDUM. Ask your Carborundum representative for literature and bulletins related to your own grinding and finishing operations. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM

TRADE MARK

BONDED ABRASIVES

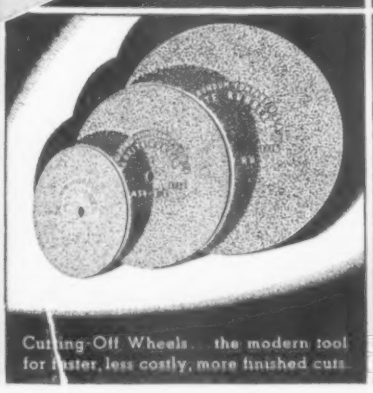
COATED ABRASIVES

ABRASIVE GRAINS AND FINISHING COMPOUNDS

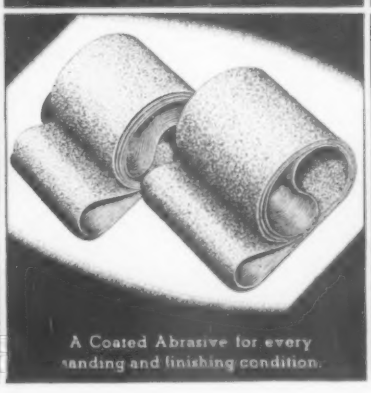
Tool Room sticks and stones that cut fast . . last long . . and hold their form.

Mounted wheels, in all standard grits and grades, for portable grinding equipment.

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.

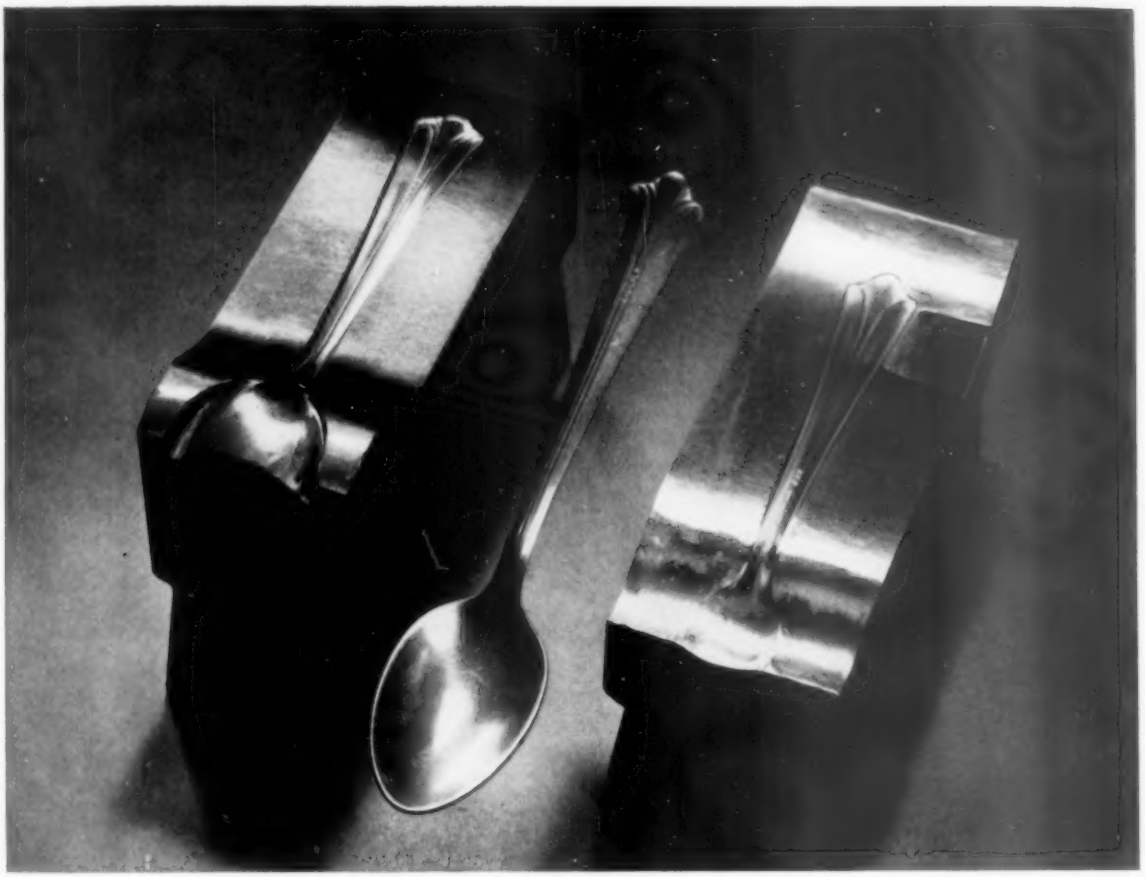


Cutting-Off Wheels . . the modern tool for faster, less costly, more finished cuts.



A Coated Abrasive for every sanding and finishing condition.

All standard shapes are supplied in grinding wheels by CARBORUNDUM.



150,000 PIECES OF STAINLESS WARE . . .
FROM STRIKING DIES OF XX Carbon Tool Steel

The shaping of stainless steel can be a tricky job. Faced with new problems in starting the production of stainless flatware, a leading cutlery manufacturer asked Bethlehem to recommend tool steel for the striking dies. (The master dies, incidentally, are hand-engraved by skilled craftsmen in the traditional fashion of this intricate art.)

Our recommendation for this difficult work was Bethlehem XX Carbon Tool Steel. The manufacturer adopted the recommendation, with highly satisfactory results. He is now striking spoons and other pieces of stainless flatware in quantities exceeding 150,000 from one impression of each production die made of Bethlehem XX Carbon Steel.

For every job in your shop requiring die or tool steel there is a Bethlehem grade that will give a good account of itself. Bethlehem Tool Steels range from straight-carbon to the high-alloy, special-purpose grades so often required in modern practice. Our specialists are always ready to talk applications with you. Call us when tool steel problems get tough—or better still, let us work with you from the start.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

★ BETHLEHEM STEEL ★

Carbon Tool Steel . . . one of Bethlehem's BIG 8 Tool Steels

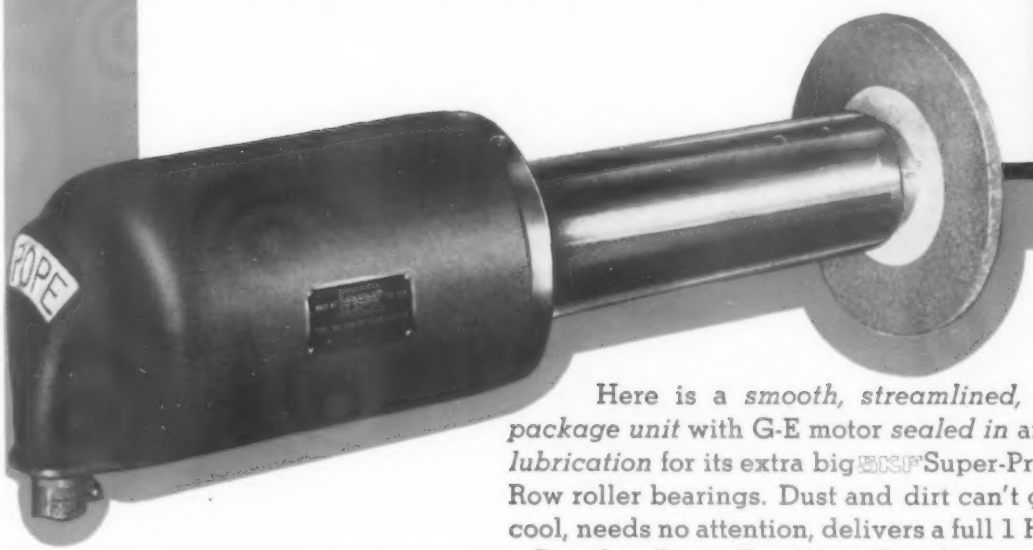
NOTICE

TO USERS OF SURFACE GRINDERS

You do better work and more of it per machine per day when your 6″ x 18″ Surface Grinders are equipped with this

POPE COMPLETELY SEALED

MOTORIZED SPINDLE



Here is a *smooth, streamlined, self-contained package unit* with G-E motor *sealed in* and with *sealed lubrication* for its extra big SKF Super-Precision Double Row roller bearings. Dust and dirt can't get at it. It runs cool, needs no attention, delivers a full 1 HP at the wheel.

Put this Pope Precision Spindle to work on your grinders and see for yourself how fast it roughs off surplus metal and what superior finishes it produces.

Let us mail you Data Sheet No. 12.

No. 41

POPE

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET · HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

★

The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
- Landmatic (for Turret Lathes and Screw Machines)
- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
- Standard Rotary Die Heads

PRECISION THREAD GRINDERS

PIPE THREADING AND CUTTING MACHINES

ROLLER PIPE CUTTERS

CHASER GRINDERS

COLLAPSIBLE AND ADJUSTABLE TAPS

The Landmaco Threading Machine equipped with the Lanco Head producing Pivot Bolts to close tolerances with 100% inspection.

Fractional Grades

CUSTOM-TAILORED GRINDING WHEELS

"Built in" *Fractional Grades* in any size Bay State grinding wheel provides a wider range for a more precise selection. This exclusive Bay State development produces wheels of three distinct degrees of hardness within the range of one normal grade.

If your present grinding wheels don't quite "fit" (slightly hard or soft), Bay State Fractional Grades is the answer. Try them.

Branch offices and warehouses — Chicago — Detroit
Distributors — All Principal cities

BAY STATE

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

RACINE HYDRAULICS

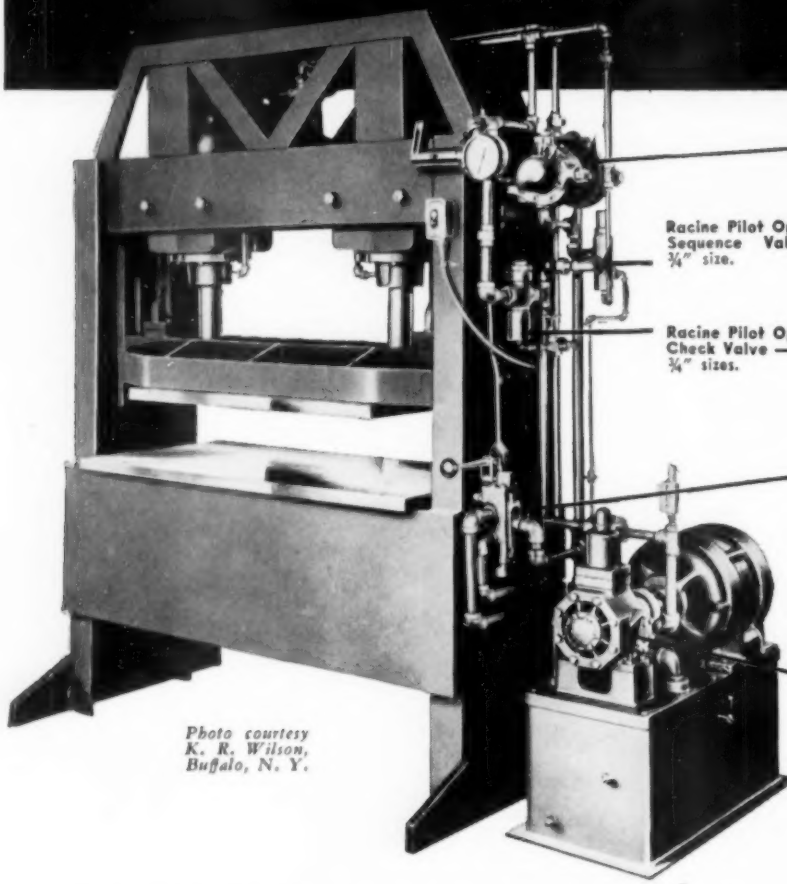
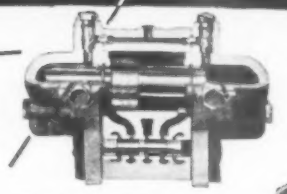


Photo courtesy K. R. Wilson, Buffalo, N. Y.

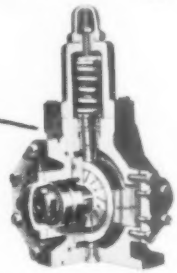


Racine Pilot Operated Sequence Valve — ¾" size.

Racine Pilot Operated Check Valve — ⅜" to ¾" sizes.

Racine Hydraulic Pressure Booster — Converts low pressures into high pressures in ratios ranging from 3:1 to 7:1.

Racine Four-Way Hydraulic Valve — Balanced Piston — Sleeve Type construction. Manual, Mechanical and Electrical control. Sizes ⅜" to 1½".



Racine Variable Volume Oil Hydraulic Pump — 12 to 30 G.P.M. Pressure 50 to 1000 lbs. p.s.i.

INTEGRATED TO YOUR DESIGN . . . CENTRALIZED OR REMOTE CONTROL

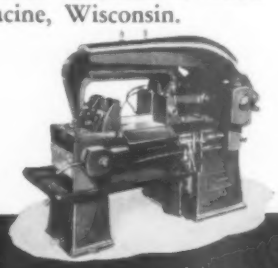
Like this press manufacturer, you can readily give your products the advantage of a RACINE "Variable Volume", hydraulic circuit. This feature saves horsepower and reduces heat by simplifying the installation and eliminating unnecessary relief and bypass valves. Important savings in first cost also result.

RACINE Hydraulic Engineers have developed hydraulic operation and control for hundreds of machines and tools. Their experience can be helpful in applying "RACINE Hydraulics" to your present product and on new designs now in the development stage. They will cheerfully review your problems in power movement, without cost or obligation.

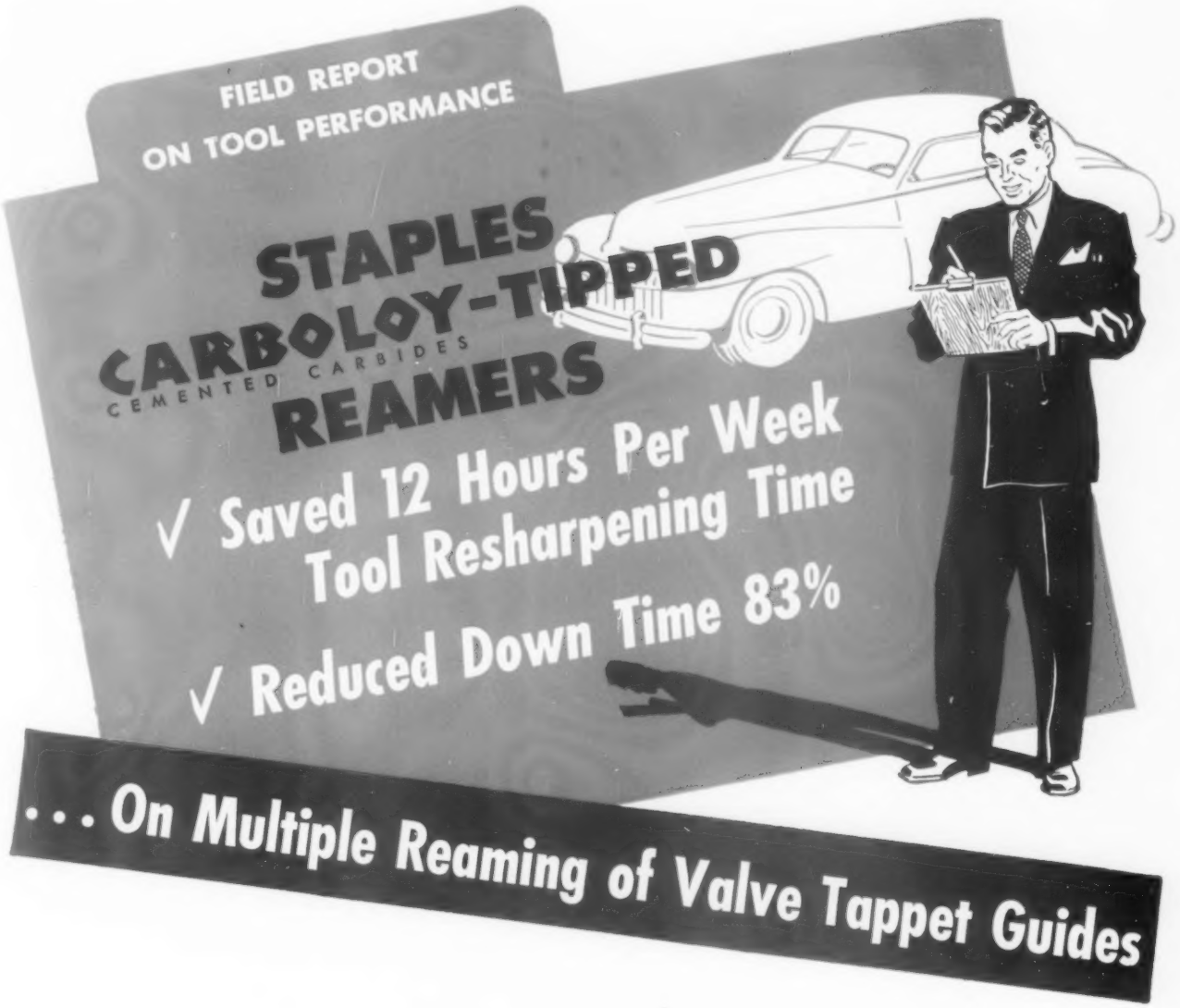
Let us submit detailed recommendations and circuits employing pressures as high as 3000 lbs. p.s.i. Utilize the Variable Volume feature of RACINE Pumps and easy operating, long-lived RACINE sleeve-type valves. Ask for RACINE catalog P-10-C today. RACINE TOOL AND MACHINE COMPANY, 1774 State St., Racine, Wisconsin.

RACINE *Hydraulic* METAL CUTTING MACHINES

A complete line in capacities 6" x 6" to 20" x 20". Models in all price ranges — featuring simple one lever control — open front design — progressive feed for cutting any metal from light tubings to structural shapes and billets of tough tool steels. Write for complete catalog No. 12.



RACINE — STANDARD FOR QUALITY AND PRECISION



To ream valve tappet guide holes in cylinder blocks, an automotive manufacturer used a multiple tool set-up of six H.S.S. reamers. Eight hours running time was the maximum production rate possible before reamers became dull and required resharpening.

At the recommendation of Staples Tool Engineers, the six H.S.S. reamers were replaced with special Staples Carboloy-tipped Reamers. As a result, tool resharpenings were reduced from five times a week to *once a week!* Prior to this changeover, the manufacturer had accepted the high tool cost as a production necessity on jobs of this type.

By replacing H.S.S.tools with Staples Carboloy-tipped Tools on routine as well as complex hole cutting operations, many manufacturers have reduced tool costs, improved tool performance and have eliminated frequent down time. *Your* production may also benefit. Call in a Staples Tool Engineer for an on-the-job demonstration. There is no obligation.

THE STAPLES TOOL COMPANY
CINCINNATI 25 **OHIO**
Distributors in Major Cities

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

Talide
(TUNGSTEN CARBIDE)
Cutting Tools

stock immediately available

Talide TOOLS AND TIPS ARE AT YOUR FINGERTIPS

We carry complete stocks of standard Talide Tools and Tips at the following warehouses. Call them for fast service:

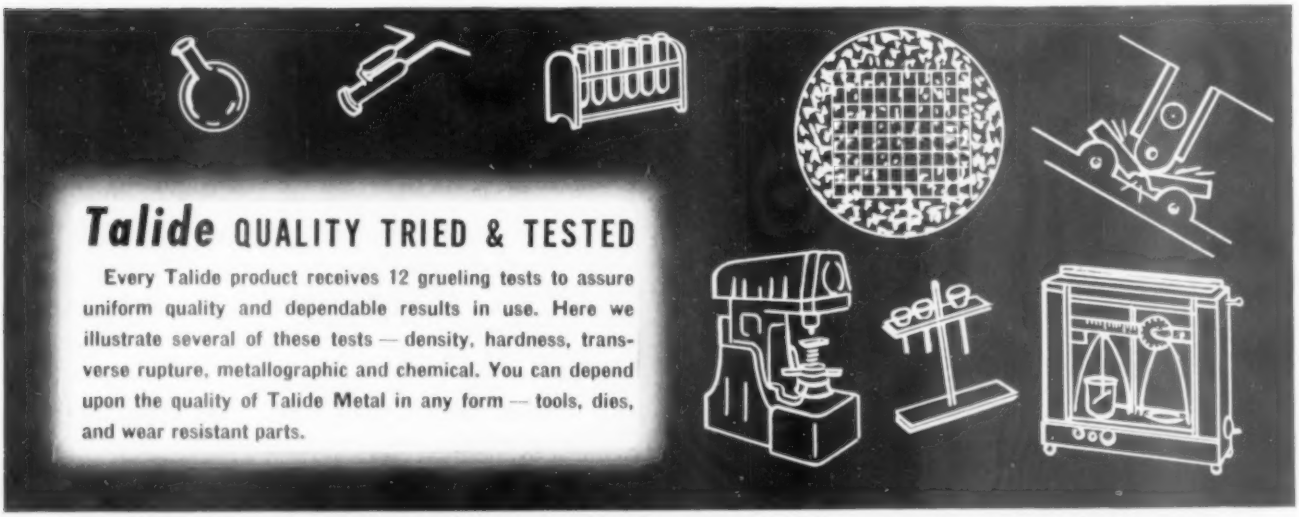
Newark 4, 166 Bloomfield Ave.
Youngstown 5, 107 E. Indianola Ave.
Chicago 22, 601 W. Milwaukee Ave.

We also have Talide sales engineers in the following territories who will be glad to assist you in any phase of tungsten carbide application, or in obtaining stock: Newark, Pittsburgh, Cleveland, Detroit, Indianapolis, and Chicago.

WHY PRODUCTION MEN USE *Talide* CUTTING TOOLS

Talide Tools remove metal 2 to 3 times faster than the fastest tool steel. Made from the hardest man-made metal, they wear much longer, and only require infrequent redressings. You can use Talide Tools for machining all kinds of steel, cast iron, non-ferrous metals and non-metallic materials.

Send for engineering-style catalog 46-T "Standard Talide Tools and Tips."



Talide QUALITY TRIED & TESTED

Every Talide product receives 12 grueling tests to assure uniform quality and dependable results in use. Here we illustrate several of these tests — density, hardness, transverse rupture, metallographic and chemical. You can depend upon the quality of Talide Metal in any form — tools, dies, and wear resistant parts.

SINTERED CARBIDES
TALIDE
HOT PRESSED CARBIDES

METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

HERE THEY ARE

Midvaloy Stainless Bars—a complete assortment available for immediate delivery. They are carried in warehouse stock in a wide variety of grades, sizes and shapes. Finishes include hot rolled, centerless ground and cold drawn. Grades regularly stocked include 302, 303, 304, 316, 410, 416, 430, 440. Prompt shipment can be made from a number of convenient locations. Ask for Midvale's stock list. It will reach you regularly and frequently—will keep you informed about supplies of Midvaloy Stainless Bars.

THE MIDVALE COMPANY • NICETOWN • PHILADELPHIA

OFFICES: NEW YORK • CHICAGO • PITTSBURGH
WASHINGTON • CLEVELAND • SAN FRANCISCO

MIDVALE

Custom Steel Makers to Industry

STAINLESS AND TOOL STEEL BARS

•

CORROSION AND HEAT RESISTING CASTINGS

•

FORGINGS AND RINGS

THE MOST IMPORTANT TAP NEWS IN 25 YEARS

"M-11" is an *exclusive* chrome-cobalt high speed steel, especially developed for Detroit taps. It provides four outstanding exclusive tapping advantages:

Higher abrasion resistance—less wear; longer tap life

Higher toughness with hardness—less chance of tooth breakage; less tooth chipping of the cutting edge

Higher red hardness—ability to tap efficiently at drill speeds or even higher

Higher torsional strength—greater resistance to twisting and breakage.

These are not idle claims. They are backed up by the performance, in all kinds of service, of hundreds of thousands of "M-11" taps produced prior to this announcement.

Typical is the statement of the Tool Engineer of one of the largest of metal working plants, that his organization has been unable to find any tap to match the "M-11" in performance.

"Of course", he says, "you have to give some of the credit to the kind of tool engineering and accuracy that Detroit Tap puts into its tools. But if you add 'M-11' on top of that—you really have something!"

If you have not yet tried "M-11" taps, you have an eye-opener coming. They are now available at no extra cost—from stock—in practically all standard and many special sizes. Try them on your toughest jobs, if you wish. A complete catalog is available on request.

Request the visit of one of our service men. There is one in your area.
Write, wire, or phone today.

GROUND TAPS
•
THREAD MILLING CUTTERS
•
THREAD GAGES AND SPECIAL THREADING TOOLS, MACHINES AND CHECKERS

DETROIT TAP & TOOL CO.

8432 Butler Ave. • Detroit 11, U. S. A.

•

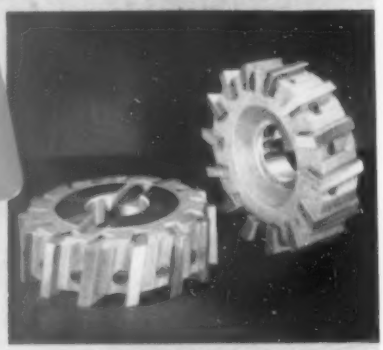
"M-11" IS USED ALSO IN ALL OF DETROIT'S THREAD ROLLS, THREAD PLUG GAGES AND THREAD MILLING CUTTERS

USE INGERSOLL INSERTED BLADE CUTTERS

FACE MILLS • HALF SIDE MILLS • STAGGERED TOOTH SLOTTING • BORING HEADS • HELICAL • END MILLS

REDUCE TOOL COSTS

REPLACE SOLID TYPE MILLING CUTTERS



TYPE NX FACE MILLS

SHEAR CLEAR FACE MILLS

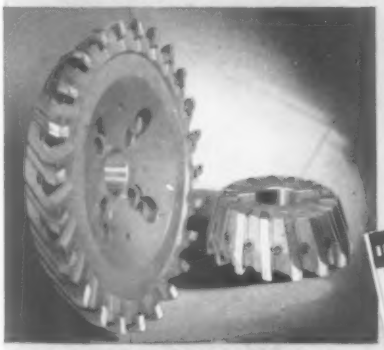
Ingersoll *inserted* blade cutters are replacing solid high speed steel and solid brazed tip designs due to economy of replacement blades. When worn out it is not necessary to purchase complete new cutters, as only the *inserted* blades are perishable. The cost of a new solid cutter is many times the small cost of a set of Ingersoll *inserted* blades.

When buying cutters always check replacement blade costs. The housing is a capital investment which lasts for many years. The blades are perishable and a continuous expense. Due to simple, though rigid, blade lock, Ingersoll *inserted* blades are less expensive. — High Speed Steel, Cast Alloy, and Carbide tipped.

END MILLING CUTTERS

HALF SIDE MILLS

INTERLOCKING SLOTTING CUTTERS



CONE TYPE FACE MILLS

This booklet shows through illustrations and charts the wide range of usefulness of the Ingersoll Cutter Grinder.

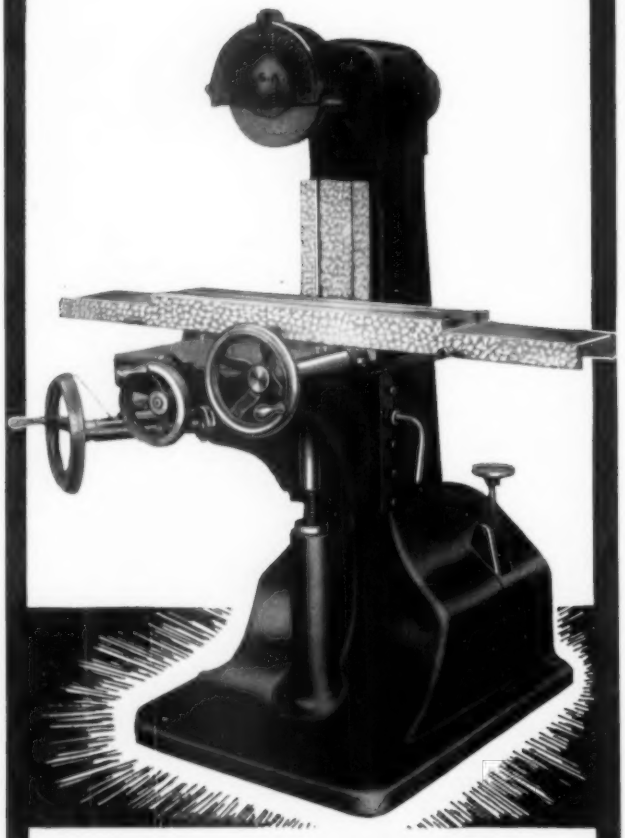
This 15" x 23" grinding chart gives basic grinds for standard milling cutters. Suitable for mounting in a conspicuous place in tool room.

This booklet is intended to help you properly select standard cutters for your work. Where these do not apply we are prepared to design and build special tools.

Write for Your Copy of these Ingersoll Bulletins

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILL., U. S. A.

NO. 11 LEACH SURFACE GRINDER



EXTRA LARGE CAPACITY

6" x 24" x 12"

HEIGHT 52"

WEIGHT 850 lbs.

2 SPINDLE SPEEDS

2600 and 3500 R. P. M.

$650.00

Complete with motor of standard Current characteristics F. O. B. Factory.

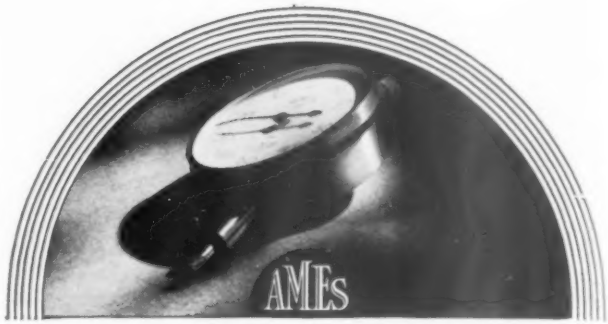
For further information write Dept. H

NATIONAL DISTRIBUTORS

H. LEACH MACHINERY CO.

187 CHARLES ST. PROVIDENCE 4, R. I.

AGENTS IN ALL PRINCIPAL CITIES



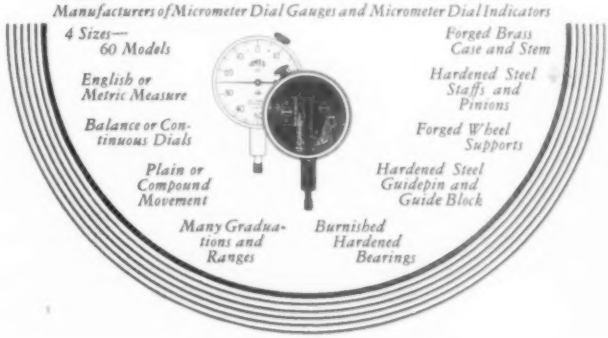
FOR MILLIONS of READINGS . . .

Insist on sensitivity, accuracy and long life in Dial Indicators—the kind that AMES has been making for 50 years.

Many features of AMES design are exclusive. Only the best materials are used. Add expert craftsmanship and you have AMES Indicators that will outlast any you can buy—at any price. Send for illustrated Catalogue.

Representatives in principal cities B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*

Manufacturers of Micrometer Dial Gauges and Micrometer Dial Indicators


4 Sizes—60 Models
English or Metric Measure
Balance or Continuous Dials
Plain or Compound Movement
Many Graduations and Ranges
Burnished Hardened Bearings
Hardened Steel Guidepin and Guide Block
Forged Wheel Supports
Hardened Steel Staffs and Pinions
Forged Brass Case and Stem

A WHOLE SHOPFULL OF TOOLS IN ONE

Machinist - craftsmen find it unsurpassed for grinding, drilling, routing, carving, sanding, polishing and 9,994 other uses. Precision-engineered, AC - DC, with more exclusive features than any other tool.

Exclusive finger-grip brings hand closer for finer work

Complete with 35 accessories in fitted steel case

$22.50

$31.75 value if purchased separately

CASCO Electri-Craft Tool Kit

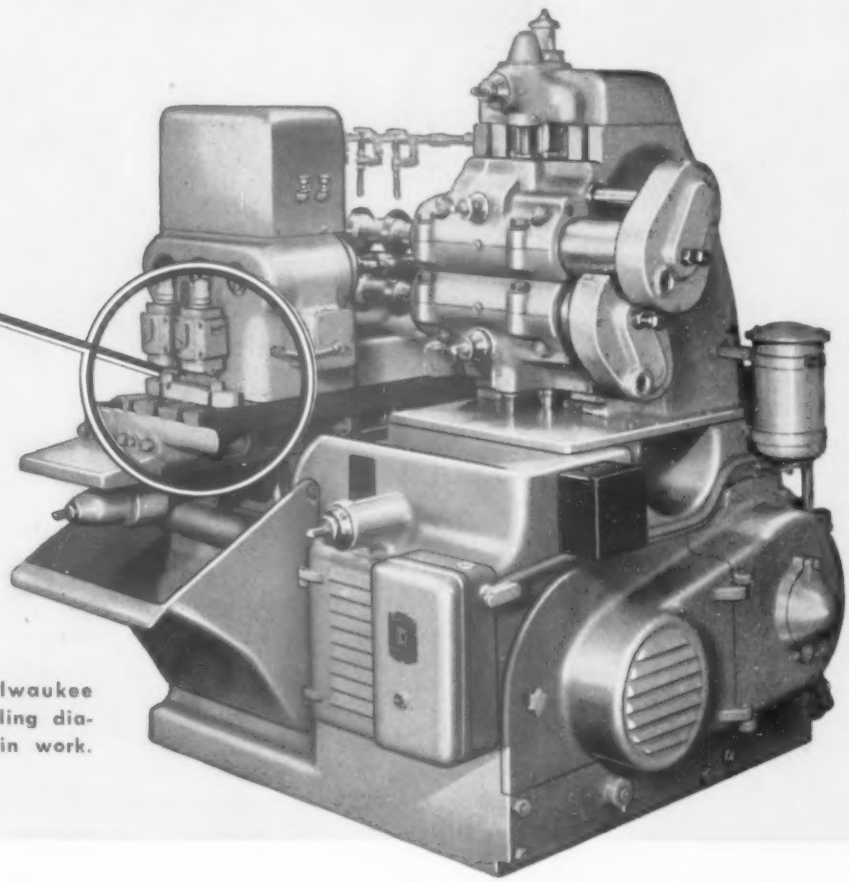
CASCO PRODUCTS CORPORATION • BRIDGEPORT 2, CONN.

VICKERS HYDRAULIC CONTROLS

Simplify Machine Operation... *Protect* Work and Machine

Vickers Hydraulic Sequence and Check Valve.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.



Kearney & Trecker Milwaukee Simplex for multiple milling diametrically opposite slots in work.

This is a representative installation of Vickers Hydraulic Controls featuring interlocking of machine operating phases by a combination of pilot interlocks and pressure sequence control valving. Three work arbors are indexed to position for simultaneous slot milling . . . accurate register and timing being assured by series connected pilot and pressure sequence interlocks. Thus all three pieces are in proper position before cutters approach the work. The same positive interlocking prevents succeeding automatic index until cutters are clear.

Other advantages of these valves: (1) they automatically provide "cushioned" operation, and (2) their ease of adjustment saves set up time when a variety of types of work is to be accommodated.

Our application engineers will be glad to discuss adaptations of Vickers Hydraulic Controls to your products.

New BULLETIN

Bulletin 45-34 on Vickers Pressure Control Valves includes operation, typical applications and installation of unloading, sequence, overload relief and counterbalance valves.

VICKERS Incorporated

1416 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

2346

TOOL FOR PRODUCTION.....AND LOWER COSTS

Hanna Riveting Presses

Tailored to your job!

If there are riveting or upsetting operations on your products, or assemblies, you may be surprised to find how much production can be increased and costs lowered with a Hanna Riveting Press *designed and built specifically for your job.* Time and again other production executives have been surprised by the production cost comparison between a general purpose and a Hanna special purpose tool. It doesn't surprise us, for Hanna has built riveting equipment of every type and nature, for every purpose, over a period of 40 years. There is experience and know-how in the Hanna organization you won't find anywhere else... It is yours to use to advantage.

Start by sending us a description of your present assembly operations and production requirements.

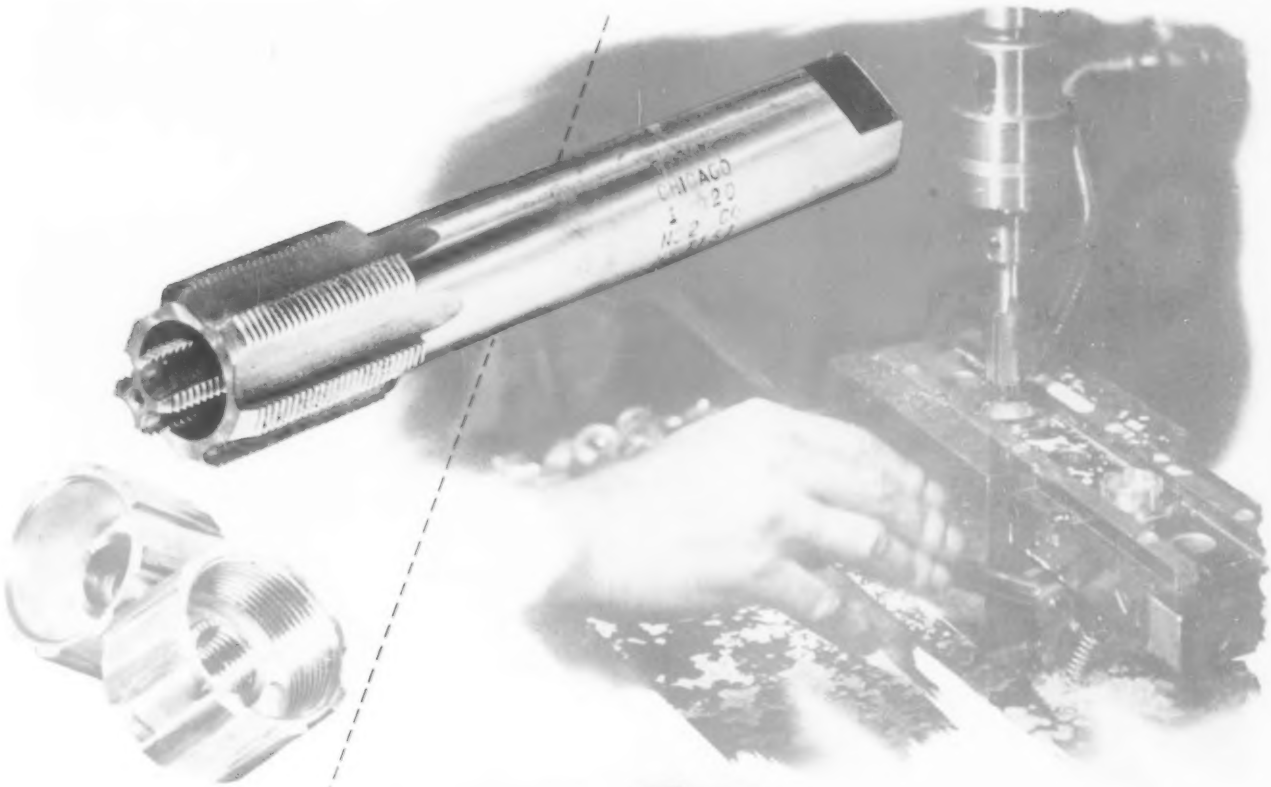
Above: This 15-ton Hanna Hydraulic Riveting Press is designed for duplex upsetting of screws.

Below: 3-½-ton Hanna Hydraulic Riveting Press built for riveting a gear assembly.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1765 Elston Avenue, Chicago 22, Illinois



BESLY TAPS AID

in Cutting Tapping Time 50%

Facts About Taps for Tap Users

This handy Manual offers valuable information on taps and tapping procedures. It's written by shop men for shop men. Drill sizes and tap fits are listed . . . Write today on your letterhead for a copy.

● GABRIEL AEROTYPE SHOCK ABSORBERS require two concentric tapped holes in die-cast aluminum pistons. Originally, these were tapped individually—a 9-second operation for each hole—*18 seconds per piece.*

In co-operation with the engineers of The Cleveland Tapping Machine Co., the Gabriel Co. developed a unique arrangement in which the smaller tap fits into the bored-out center of the larger tap. Two holes are now tapped simultaneously in 9 seconds—a saving of 50% in tapping time.

In such operations, Besly Taps contribute top accuracy and production economies. Leading American industries depend on them for clean-cut, low-cost threading.

"Special" or stock design, there is a Besly Tap to meet your need. Ask your distributor about Besly Taps and Besly Tap engineering service.

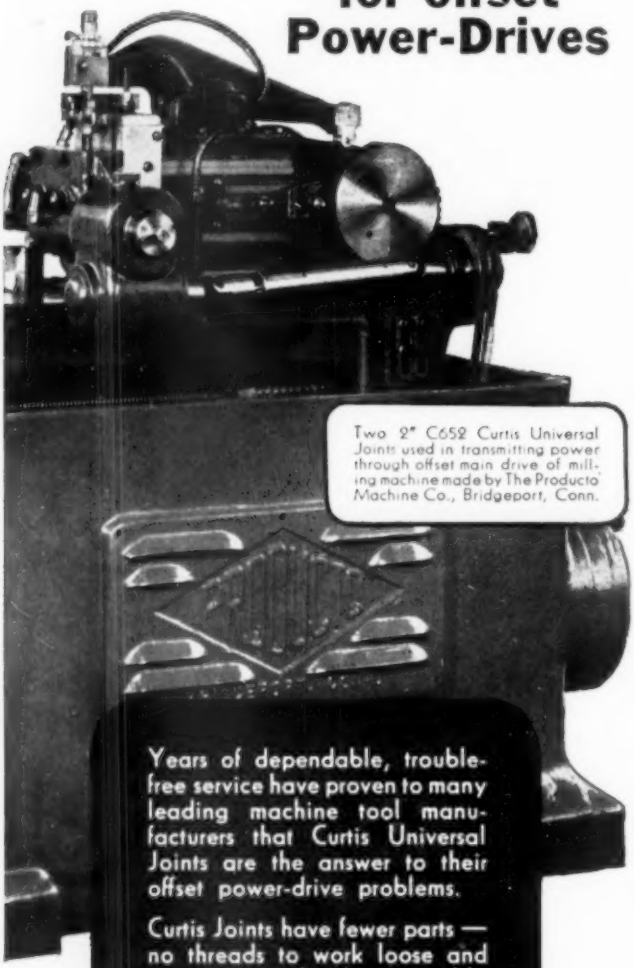
BESLY

BESLY TAPS • BESLY TITAN ABRASIVE WHEELS
BESLY GRINDERS AND ACCESSORIES

CHAS. H. BESLY & COMPANY, 118-124 N. Clinton St., Chicago 6, Illinois • Factory: Beloit, Wis.

EFFICIENT...

for offset Power-Drives



Two 2" C652 Curtis Universal Joints used in transmitting power through offset main drive of milling machine made by The Producto Machine Co., Bridgeport, Conn.

Years of dependable, trouble-free service have proven to many leading machine tool manufacturers that Curtis Universal Joints are the answer to their offset power-drive problems.

Curtis Joints have fewer parts — no threads to work loose and are precision fitted in assembly to insure a smooth, positive-action joint that gives maximum life with minimum maintenance — factors of real importance in power drives.

Available in 14 standard sizes from 3/8" to 4", either single or double. Quotations on special sizes, bores or tolerances gladly made, upon request.

Write for Engineering Data and drafting templates.

WRITE DEPT. B-2

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD MASS.

DRILL JIG BUSHINGS

Accurate

Interchangeable

Acme
Industrial
Company

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UNIVERSAL • STURDY

It is an all purpose attachment which has thoroughly proved itself all over the world. Ideal for the making of plastic molds, die casting molds, permanent mold casting molds, metal patterns, tool and die making, production work of all kinds, as well as for grinding, drilling, boring, etc.

DIRECT DRIVE OR BACK GEARED
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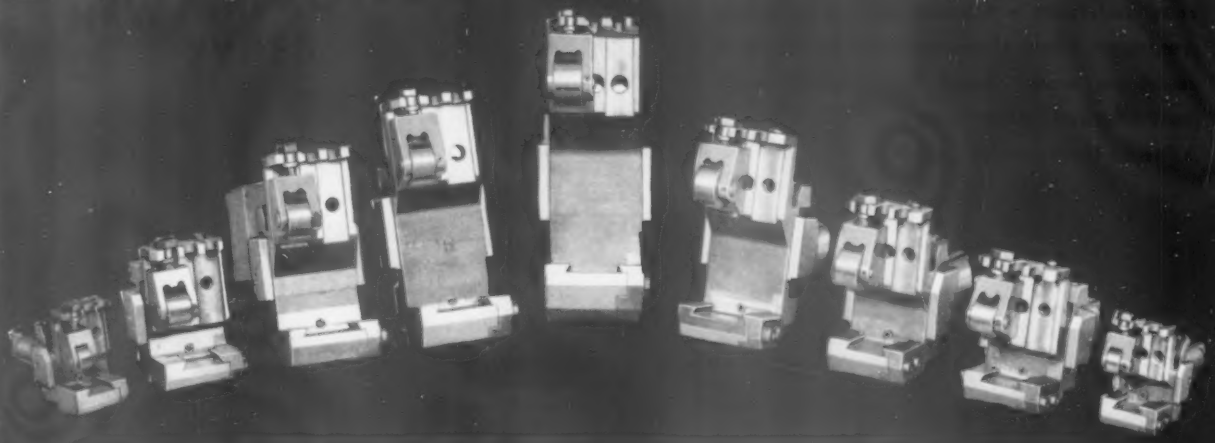
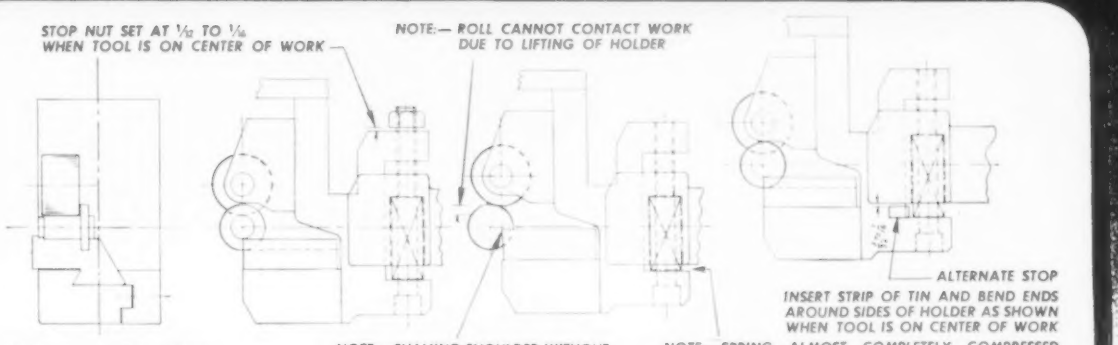
Slitters




STOP NUT SET AT 1/32 TO 1/16 WHEN TOOL IS ON CENTER OF WORK
NOTE:— ROLL CANNOT CONTACT WORK DUE TO LIFTING OF HOLDER
ALTERNATE STOP
INSERT STRIP OF TIN AND BEND ENDS AROUND SIDES OF HOLDER AS SHOWN WHEN TOOL IS ON CENTER OF WORK
NOTE:—SHAVING SHOULDER WITHOUT STOP CAUSES TOOL TO DIG IN LIFTING HOLDER AS SHOWN—MAY BREAK TOOL
NOTE:—SPRING ALMOST COMPLETELY COMPRESSED FROM LIFTING OF HOLDER. IT IS POSSIBLE FOR HOLDER TO RAISE BALANCE OF CLEARANCE SHOWN RAMMING BOTTOM OF SHANK

HOW TO SET STOP SCREW ON SLITTERS SHAVE TOOL HOLDERS

FOR RESTRICTED CENTER DISTANCES

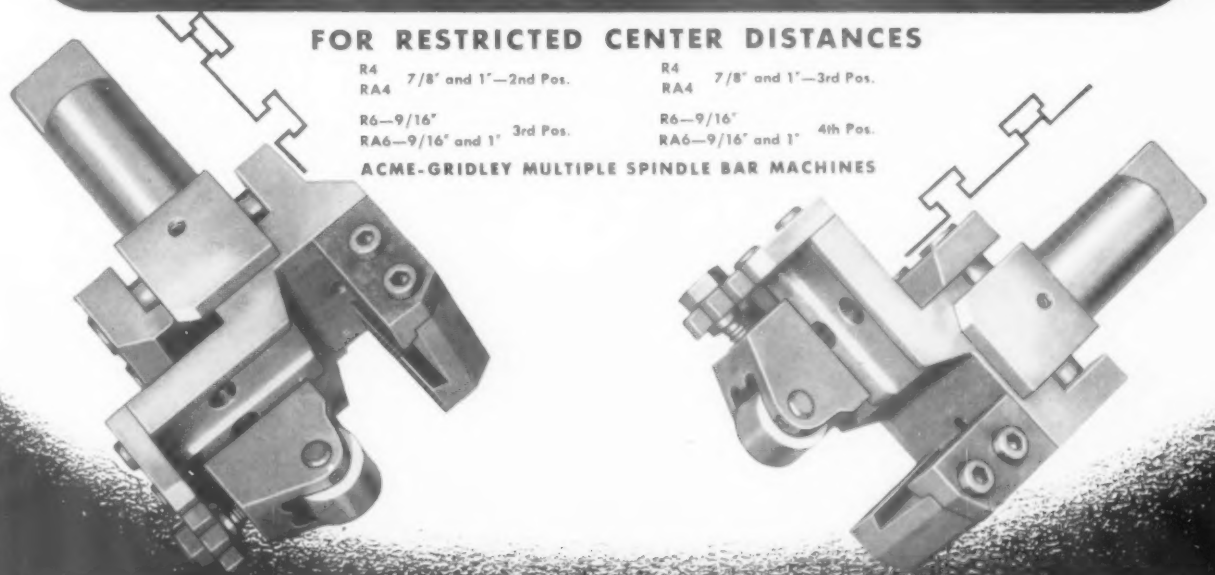
R4
RA4 7/8" and 1"—2nd Pos.

R4
RA4 7/8" and 1"—3rd Pos.

R6—9/16"
RA6—9/16" and 1" 3rd Pos.

R6—9/16"
RA6—9/16" and 1" 4th Pos.

ACME-GRIDLEY MULTIPLE SPINDLE BAR MACHINES



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More output between dressings

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High mechanical properties at low cost...

That's the reason why more and more Nickel-molybdenum cast iron dies are in demand for stamping, pressing, striking and similar operations where unalloyed iron formerly was used.

Nickel-molybdenum cast iron gives much better response to heat treatment... its high machinable hardness permits greatly increased output with fewer dressings, and its ability to take a high polish tends to eliminate galling of pressed parts.

The dies shown above, one of which weighs 5,599 pounds, were cast in a high test nickel-molybdenum iron at the foundry of Apex Steel Company, Los Angeles. Since tensile strength of 40/45,000 p.s.i. was specified for the castings, they were produced in an iron of the following analysis:

Total Carbon	3.04%
Silicon	1.71%
Nickel	2.09%
Molybdenum	0.63%

Test specimens machined from 1.2 inch bars gave an average tensile value of 61,989 p.s.i. The transverse strength was 5,157 lb. with deflection .42" (test on "B" bar, 18" centers).

Our casting specialists are always glad to recommend suitable compositions of Nickel cast iron for specific applications. We invite your inquiries.

INCO Nickel
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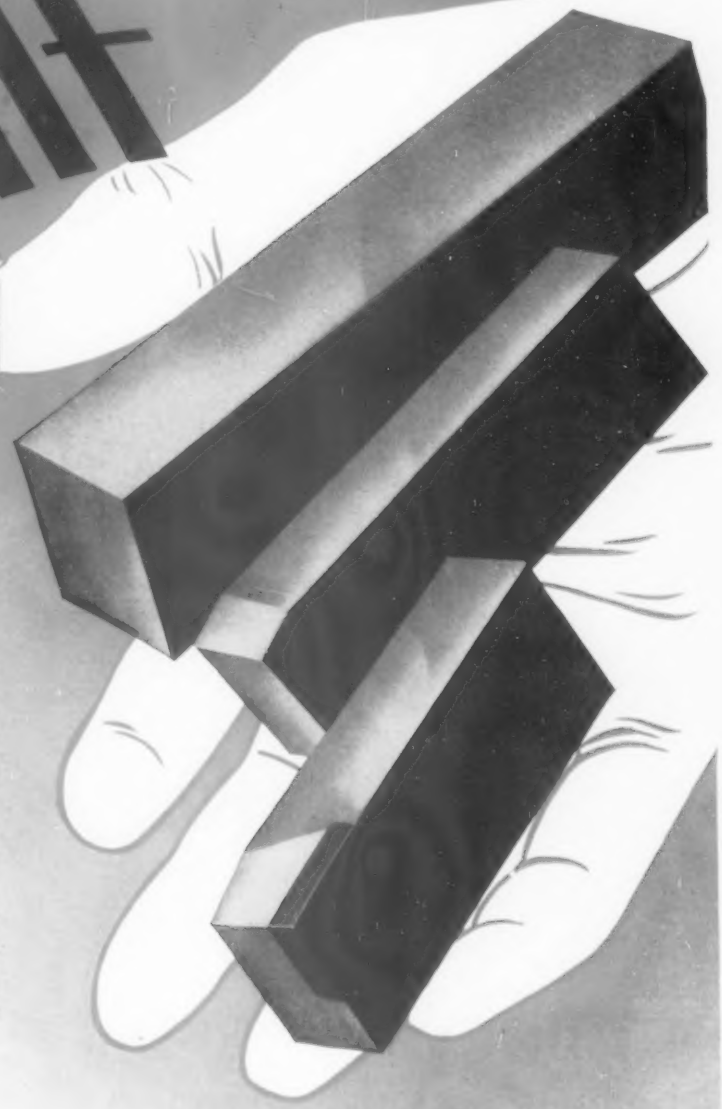
Over the years, International Nickel has accumulated a fund of useful information on the selection, fabrication, treatment and performance of alloys containing Nickel. This information and data are yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Crobalt Quality



Crobalt is a hard alloy (containing principally chromium, cobalt, tungsten, vanadium, zirconium and carbon), cast in the form of tool bits and inserted milling cutter blades especially developed for high speed production. At high temperatures (up to 2000 degrees) Crobalt cutting qualities remain constant.

The cutting edges of a Crobalt tool stay sharp longer, and thus assure you of much greater tool life between grinds. This automatically increases production by reducing "Down-time" ordinarily required for changing of tools. Try Crobalt in your shop.

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Inserted Milling Cutter Blades

Crobalt now fabricates carbide tipped inserted milling cutter blades. Any make of tungsten carbide can be furnished. Prices for this type of blade are unusually low and the product and finish are unexcelled. We manufacture blades of all types and sizes. Send us your prints for quotation.

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FLAT HEAD
CAP SCREWS

For perfect countersink-fit; positive wrenching — and more!

(1) Flush top surface with no gap between screw head and surrounding metal.

(2) Extreme rigidity of grip, because angle of head helps lock screw in place by drawing down on a conical surface.

(3) Firmer hold on thin plates of metal, by more binding surface under the head than in fillister type or cheese-head screws.

(4) Shallower countersink — less weakening of metal — when used for fastening a relatively thin plate.

(5) Positive engagement of hex key transmits power for tightest of set-ups without slipping, reaming or side play.

(6) Maximum strength of screw itself assured by *"pressur-forming"* of special-analysis ALLENOY steel. Threaded to a high Class 3 fit.

(7) Speed in assembly provided for by use of Allen hand drivers and key blades for power drivers.

Order of your local ALLEN Distributor, — or ask him for samples and engineering data for preliminary try-out. Get *proof* that these screws perform as dependably as Allen Hollow Set Screws and Socket Head Cap Screws.

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TOOL STEEL

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"Shut down" emergencies occur sooner or later to all users of tool steel. The cause of this unexpected delay must and can be promptly overcome.
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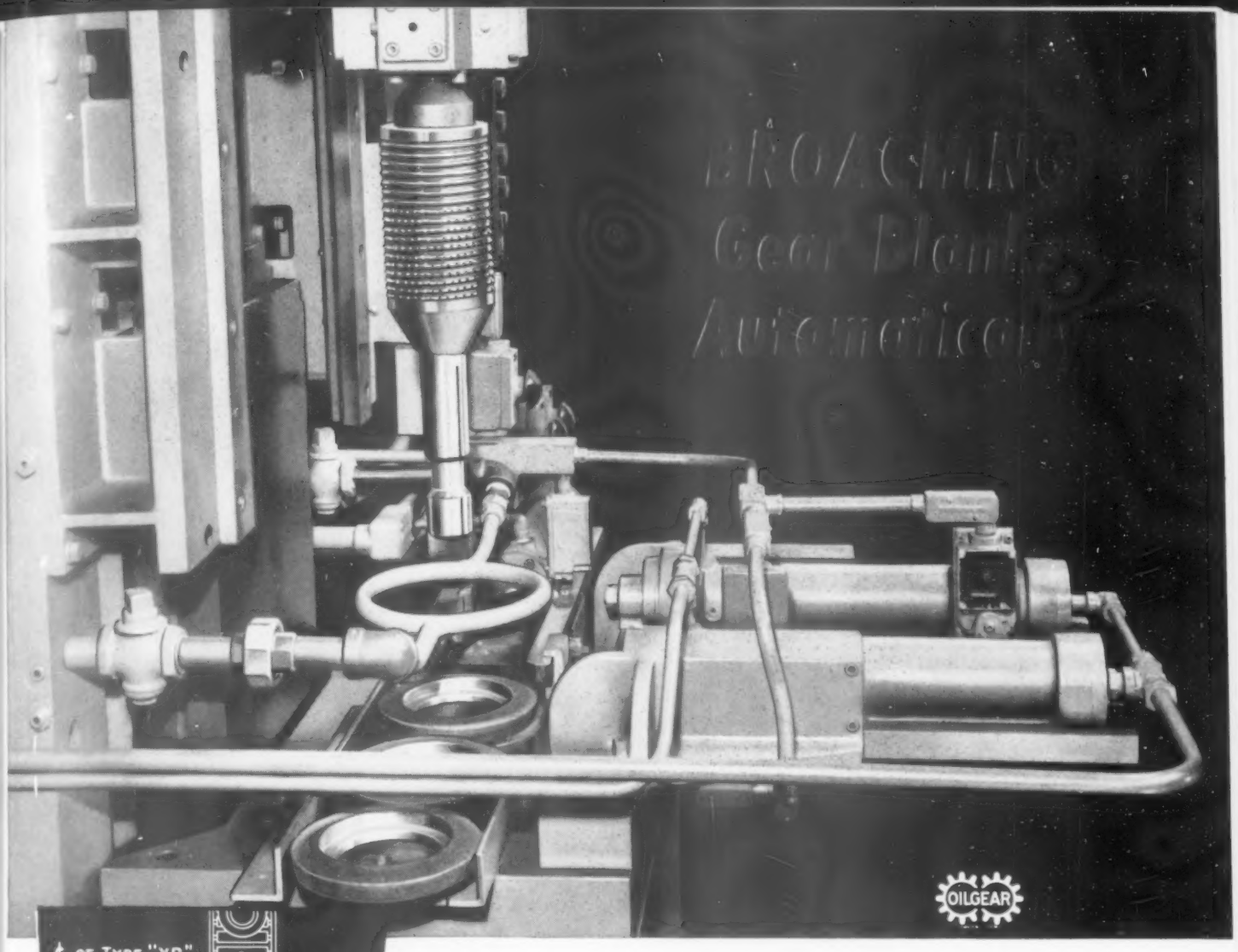
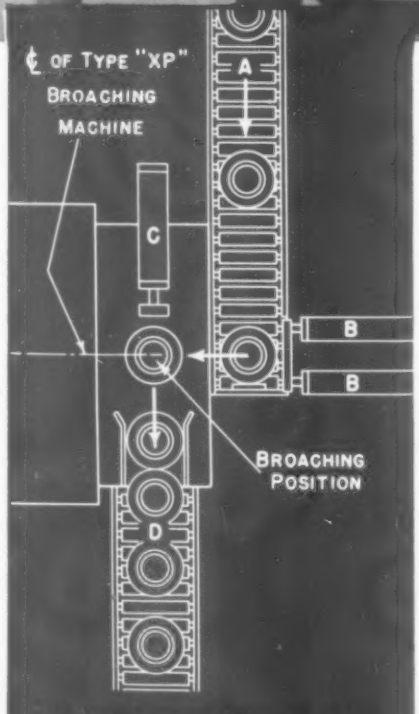




Oilgear Vertical Pull-Down Broaching Machine continuously loads, broaches and unloads hypoid bevel gear blanks . . . *automatically.*

This Oilgear Type "XP" Vertical Pull-Down Broaching Machine with automatic loading and unloading mechanism is operating at the Fort Wayne plant of the Spicer Mfg. Co. Its job is to finish broach holes in the forged steel hypoid bevel drive gear blanks fed to it from a boring machine by means of a conveyor.

Two fluid power cylinders remove the blank from the conveyor and place it in the broaching position on the machine. As tool descends, shank accurately locates blank. Tool is pulled downward to broach part. Another fluid power cylinder pushes the finished part onto a second conveyor which takes it away. There's no manual loading—no levers or buttons to operate—no manual threading of part over tool shank—no cautious centralizing of part by hand—no manual handling of tool—no manual unloading. All operations are automatic, continuous and unattended.

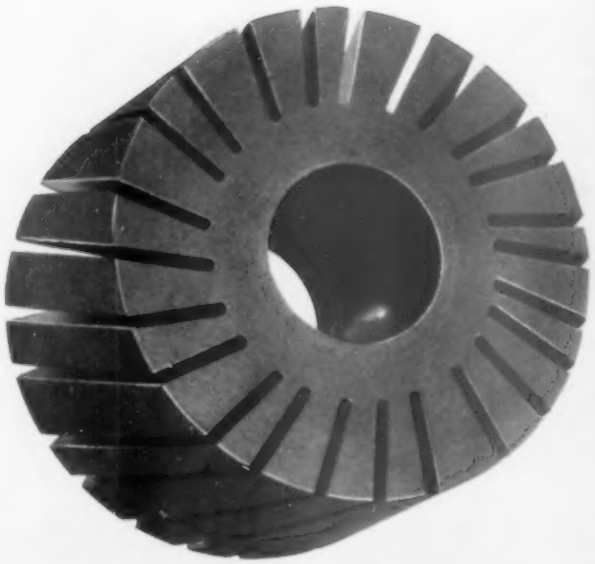
The Oilgear Automatic Broaching Machine removes approximately .020" of stock on the diameter and produces 225 finished ring gear blanks per hour. Other sizes of bevel gear blanks can be broached on the same machine by changing the broaching shells on the tool steel bar.

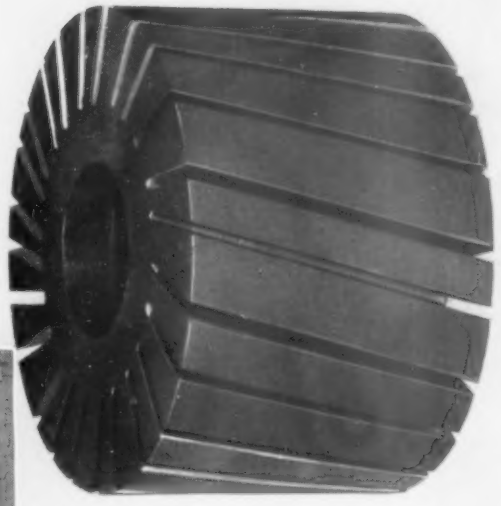
If you are looking for faster production and lower costs, investigate Oilgear Broaching Machines, either vertical or horizontal for every type of internal and external broaching. They provide high broaching and return speeds, infinitely adjustable. They make more efficient use of electric power hence require smaller motors. They make more efficient use of oil medium hence require much smaller reservoirs. They provide manual, semi-automatic and full automatic control at no extra cost. THE OILGEAR COMPANY, 1308 W. Bruce St., Milwaukee 4, Wis.

Oilgear Fluid Power

WAS TWO HOURS PER PIECE— NOW TWO PIECES PER HOUR

Campbell Abrasive Cutting Machine, used for cutting slots in crusher rolls, reduces a two-hour operation to 25 minutes—reduces rejects to an absolute minimum.



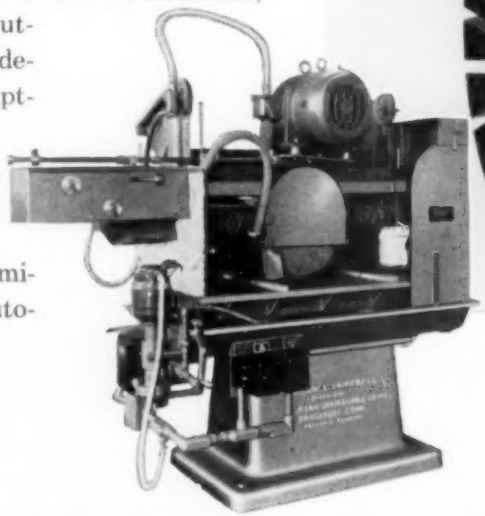


BRIDGEPORT, CONN.—Here is a typical production job for a Campbell Abrasive Cutter.

These crusher rolls are used for forming grinding wheels. The old method of cutting the slots before heat-treating resulted in a high percentage of rejects. Time for cutting 22 slots, about 2 hours. And, because the bottom of the slot was square, many of the rolls failed to stand up under the required high pressure of use.

Cut abrasively after hardening and heat-treating, the slots have a radius at the bottom. Rejects are negligible. The finished rolls are much better able to stand pressure. And the daily average for the cutting operation is now two pieces per hour.

Originally designed as cut-off machines, Campbell Abrasive Cutters with Campbell-designed fixtures are adaptable to many production machining operations. The Campbell line includes manual, semi-automatic and full automatic machines.



Perhaps you have a problem we could help solve. Our engineers will be glad to work with yours.

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SPEEDIER, SIMPLER, SURER INSPECTION

Small threaded work or large unwieldy pieces are inspected faster, easier, and *with master gage accuracy* on Bryant Thread Gages. Two types, Bench and Portable, will check internal and external threads up to 8" and 3" respectively—the Portable Gage being ideal for inspection of internal threads in heavy castings, or work still chucked in the machine. Both gages employ the new Bryant principle of three point contact (two stationary thread segments—one retractable segment) and visual accuracy indication. Bryant Gages eliminate tedious threading, thereby increasing segment life and doing away with the groping "feel for fit" on the part of the inspector. They are so easy to operate that even a novice can become proficient in less than a day. In fact, all he has to do is press a lever, engage the segments, give the part or gage a partial turn and watch the dial indicator—immediately, size, presence of burrs, accumulated inaccuracies of pitch, lead, diameter and thread form are indicated. The Bryant Method of inspection is at least four to five times faster than the ring and plug gage system.

Are you interested in a speedier, simpler and surer inspection method for your threaded parts? Use the coupon below for complete details on Bryant Bench and Portable Thread Gages. This little effort now may save you hundreds of dollars in the future.

at the bench
INTERNAL & EXTERNAL

at the machine
INTERNAL & EXTERNAL

Also Manufacturers of Squareness of Face Gages and Universal Diameter Size Gages —plus a complete line of internal grinding machines.

Please send me Catalog No. G3 which gives complete details on the Bryant Thread Gages.

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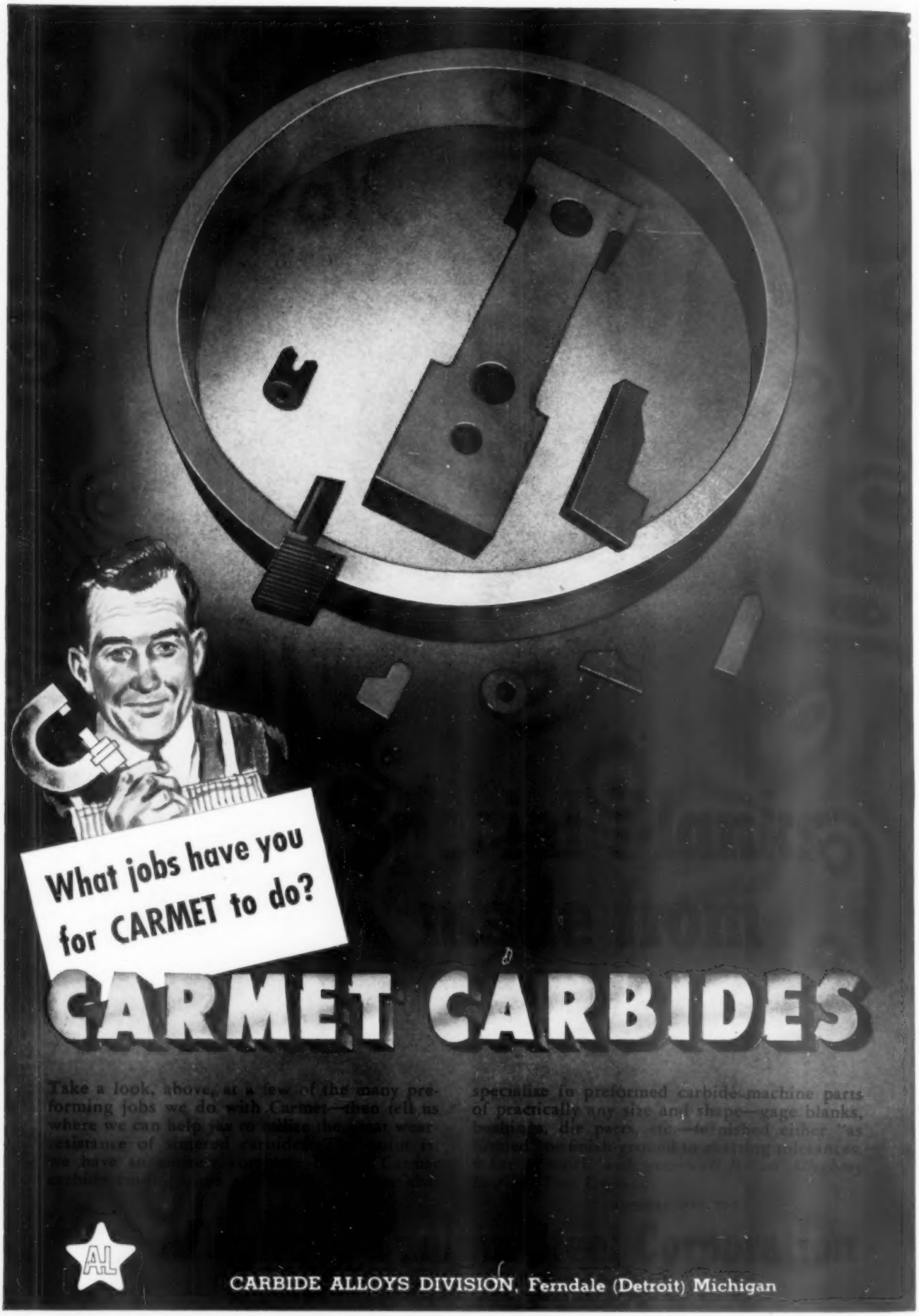
BRYANT CHUCKING GRINDER CO. SPRINGFIELD, VERMONT, U. S. A.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Take a look, above, at a few of the many pre-forming jobs we do with Carmet—then tell us where we can help you to utilize the super wear resistance of sintered carbides
specialize in preformed carbide machine parts of practically any size and shape—gage blanks,
CARBIDE ALLOYS DIVISION, Ferndale (Detroit) Michigan

PERFECT HOLES

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- A NEW MACHINING METHOD! ROTARY BROACHING *
- A NEW NAME-"**ROTARY BROACH**" *

ROTARY BROACHES may be used in lathes, turret lathes, automatics, drill presses, etc., to replace reamers. They produce perfect holes with finishes that can only be compared to honing. They last longer before grinding is necessary and may be resharpened 10 to 30 times. They produce perfect holes at a fraction of the cost of those produced by other methods Eliminates grinding, lapping, honing and boring.

USE THIS NEW MACHINING METHOD—ROTARY BROACHING*

You Cannot Afford Not To Use Rotary Broaches (Write for free descriptive literature)

*** "Rotary Broach" and "Rotary Broaching" are new names coined and copyrighted by Shearcut Tool Company.**

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DEPT. D-3, RESEDA, CALIFORNIA

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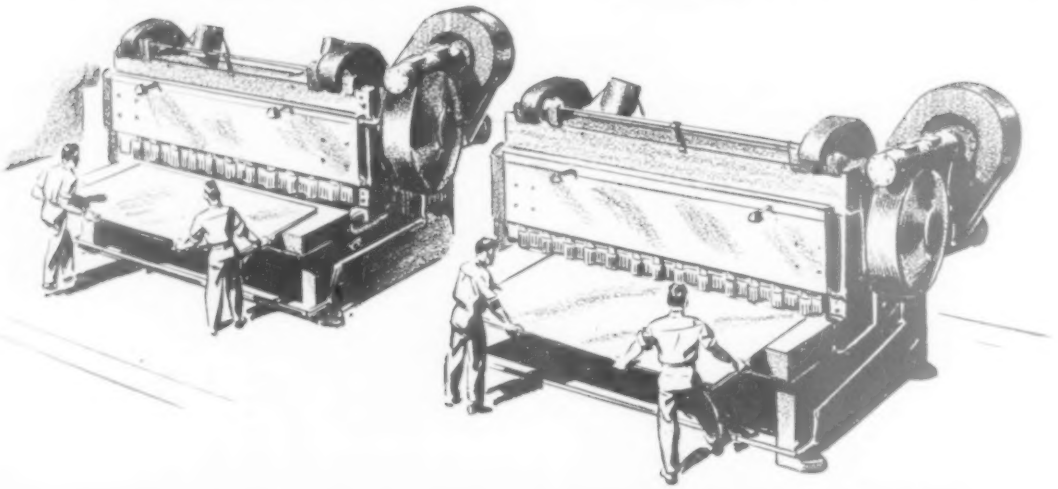
IN HEAVY INDUSTRY...



Leadership BUILDS ON *Craftsmanship*

More than 43 years of engineering development stand behind every WINTER Tap. The WINTER Chip Driver Tap (pictured below) was developed for extremely fast operation in tough alloys. Designed to make a shearing cut which turns the chips ahead of the tap, its productivity far exceeds other types of taps for many applications. The WINTER Chip Driver Tap is one of a complete line of carbon and high speed steel precision-made Taps and Dies.

Craftsmanship of the highest order always has been employed in the manufacture of WINTER Taps.

Your local distributor carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the phone on your desk.

Winter Brothers COMPANY

WRENTHAM, MASS. and ROCHESTER, MICH. • Distributors in Principal Cities

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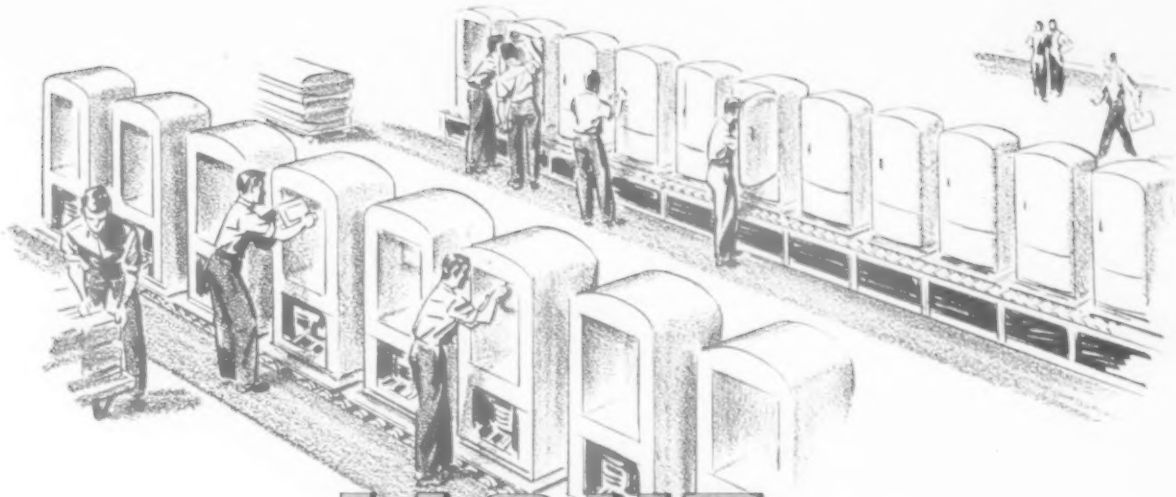

AND IN LIGHT INDUSTRY

NATIONAL Reamers, like all NATIONAL tools, are engineered to give top efficiency in your metal cutting operations. Precise engineering of the proper proportion of lands and flutes, for example, prevents clogging or overheating during reaming operations. By thus eliminating a primary cause of premature dulling, longer tool life is assured. NATIONAL Reamers are part of a complete line of NATIONAL Rotary Metal Cutting Tools in carbon and high speed steel.

Craftsmanship **INSURES** *Quality*

The skill and facilities to make NATIONAL Tools the best you can buy are supplied at NATIONAL'S great new plant in Rochester, Michigan.

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NATIONAL TWIST DRILL AND TOOL COMPANY

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TAPPING TIPS

From Woody Spencer's Notebook

OVERCOATS for TAPS

One thing a lot of the boys gripe about is gettin' a fresh tap from the tool crib and then findin' it's no good 'cause the edge has been damaged. Way I figure it, keepin' taps in shape is as important as usin' 'em. Most shops have some way of protectin' fresh sharpened taps but the best I've seen lately is in a big shop where they use lots of taps. They dip taps (and other edged tools) in a nitro-cellulose solution (dope to you) after sharpening. Then they strip off the coating when they hand out the tap. Coatin's are remelted and used over again. Sure keeps the taps in good shape and saves a lot of time and trouble changin' and regrindin' taps.

These Tapping Tips of Woody's aren't intended to offer any technical advice or suggestions on tapping problems. They're merely ideas, hints and short cuts Woody has picked up in his rounds of the shops and they're put in here to help as much as they can in making routine tapping jobs run a little smoother and quicker.

For the technical problems that come up with so many tapping jobs, it's wise to get advice from the engineers. Send us complete information on the job — material to be tapped, diameter and depth of hole, whether it's through or blind, allowance for chip clearance, lubricant used, etc. Our engineers will be glad to give you definite, technical suggestions covering the problem.

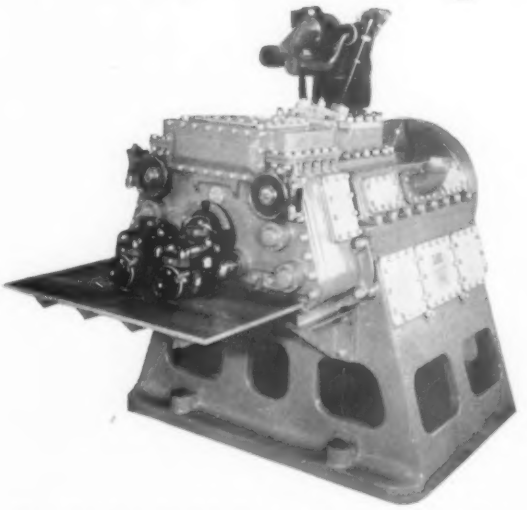
NOTE: Woody Spencer's Tapping Tips will appear here as often as Woody gets time to write them up. Look for them.

Woody Spencer's Handy Tap guide is packed with useful information on tapping. It's free. Write for your copy on the Company letterhead.

THE RIGHT TAP AT THE RIGHT TIME

The Wood & Spencer Company
Cleveland 3, Ohio

Let Merz Solve Your Unusual Problems of Precision Design



If you're faced with the problem of designing and building an unusual, high-precision experimental engine or test machine, look to MERZ for a sound solution. MERZ is equipped with the best in men, machinery and methods . . . plus the experience of building the most exacting machines for leading research organizations.

Pictured above is a typical example of MERZ work in this specialized field—a single-cylinder, high-precision engine with piston-balanced crankshaft and accessories for testing aircraft cylinder head assemblies—plus testing and developing fuel and ignition systems for high-altitude flying. The extreme accuracy and efficiency in-built in this machine is representative of the workmanship in other MERZ specialties—standard A.G.D. and special gages, tools, dies and other precision products. Write for the full facts on MERZ "four spheres of service" today!

WATCH FOR SPECIAL ANNOUNCEMENT SOON ON NEW MERZ AIR GAGES!

MERZ Engineering Company
INDIANAPOLIS 7, INDIANA

DID YOU KNOW . . . that a large percentage of economy in carbide tool applications is wasted in converting standard tools to shop requirements. The practical solution to high tool conversion costs is V-R "CUSTOMER STANDARDS." Write or call your nearest Vascoloy-Ramet Field Engineer for full information on your "CUSTOMER STANDARD" tools.

SEND for your copy of the NEW VR-400 Carbide Tool and Blank Catalog. 32 pages of vital carbide engineering data. Address Dept. TE-247.

The amazing growth of cemented carbides in the past decade has opened the way to tremendous production increases. Vascoloy-Ramet, manufacturers of V-R Tantalum/Tungsten carbides is foremost in the development of carbides in industry. In keeping with this tradition of leading industry in carbide tool performance, V-R now takes another significant step forward by introducing V-R "CUSTOMER STANDARDS." Studies reveal that most users alter standard carbide tools before putting them to work ...an entirely unwarranted cost! BECAUSE TODAY...V-R "CUSTOMER STANDARD" tools, made to your design, can be used without ANY alterations, available in any grade and quantity at prices, less in fact, than it costs you to alter your present standard tools to shop specifications.

MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS. U. S. A.

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AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

TOOLS for PRECISION PRODUCTION

The Modern Way to Mark Tools and Parts!

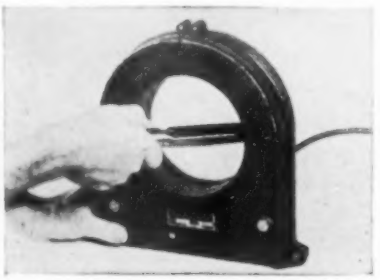
ELECTRIC ETCHERS

Write on steel with electricity. This is a quality tool noted for its smooth etching action. Will stand up under rough shop use. Weighs only 22 lbs. Overall case dimensions—4¼" x 8" x 10". Standard 6-ft. cord and plug for operations from 110-volt 60-cycle A.C. current. Complete with new, patented offset stylus.

●

Clinging Particles Mean Dull Equipment!

DEMAGNETIZERS



With this 6" "Through Type" Demagnetizer, merely pass the work or tool through the opening and remove to a distance of one or two feet before turning off the current. To speed up production, work may be dropped through by gravity. Operates from regular power lines. No moving parts. Other standard sizes from 4" x 24" to 18" x 24".

●

IN STOCK—*Subject to Prior Sale*

- MAGNETIC CHUCKS
- MAGNETIC BLOCKS
- STANDARD CARBIDE TOOLS

PRECISION PRODUCTION TOOLS

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ACME TOOL COMPANY

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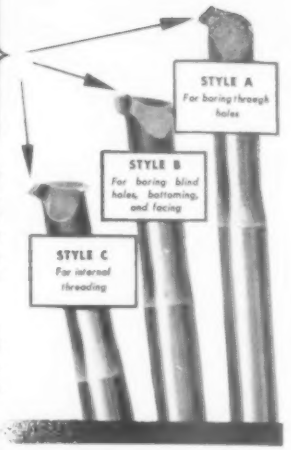
YOU RESHARPEN ONLY ONE FACE OF BOKUM TOOLS

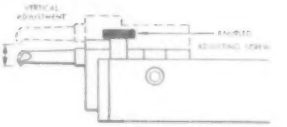


Thus the original form of these boring and internal threading tools is never changed. The angle of the cutting edge and the special helical backed-off form of the front of the tool (A and B) produce a free cutting action that is constantly retained—even through resharpening.

Send for folders that show complete range of sizes. Choose the tool you require and try it on your machines. See how much faster and more economical Bokum Tools perform. *Send for Cat. N-1138 for high speed tools; N-398 for carbide tipped tools.*

THIS NEW HOLDER GIVES YOU VERTICAL ADJUSTMENT

A simple turn of knurled screw on top of holder moves tool in vertical plane to give the precision setting you want. Rocker of tool post can be left out and shims are not needed. Here is a worthy advancement in boring tool holders. Two sizes: BT-0 shank size, ⅜"x 1"; BT-1 shank size, ½"x 1¼"



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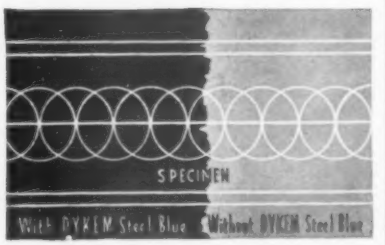

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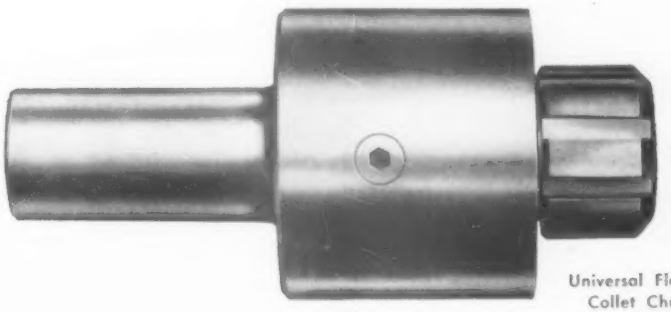

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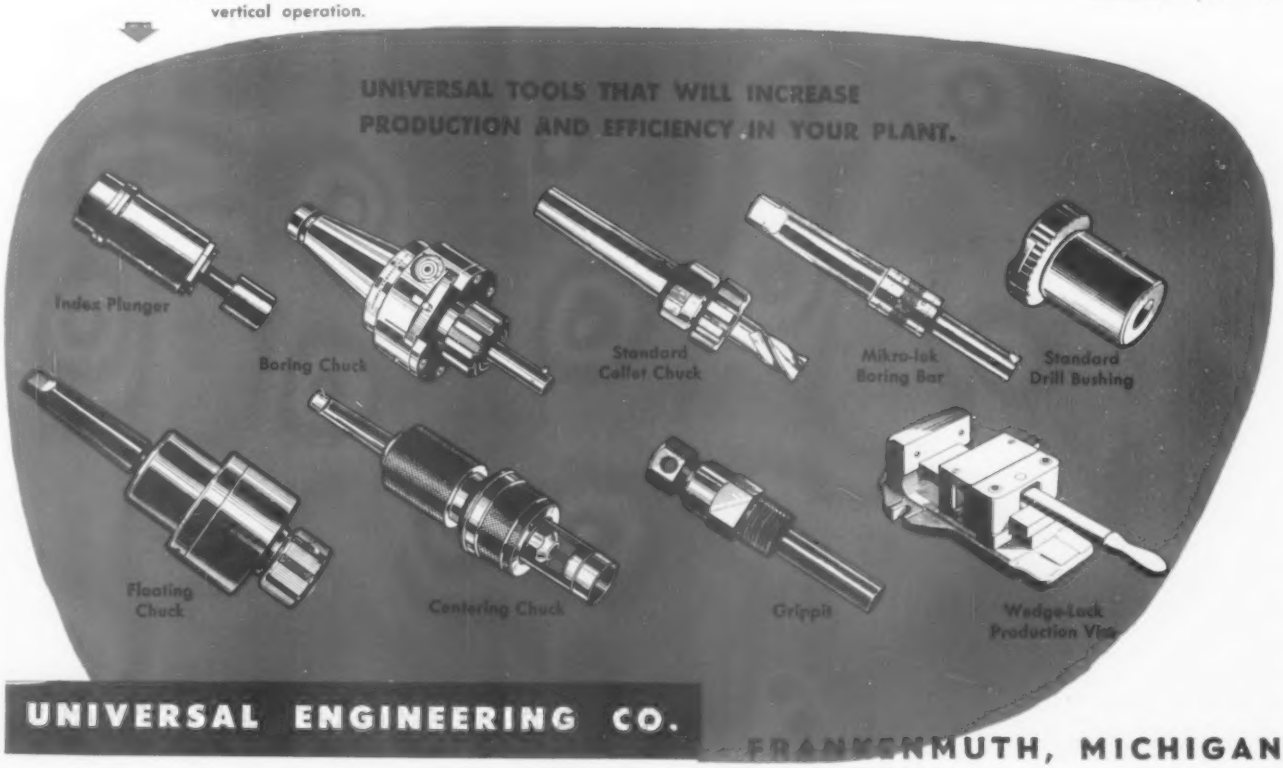
Universal Floating Collet Chuck for horizontal operation.



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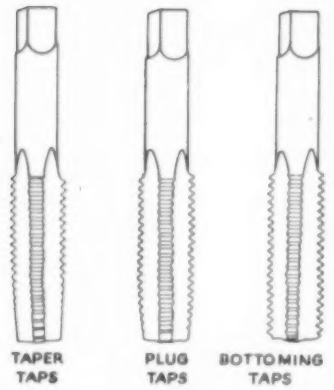

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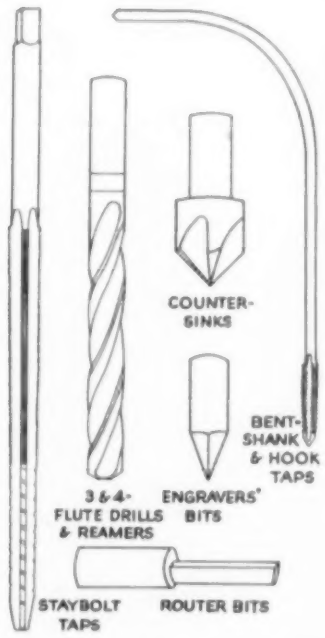

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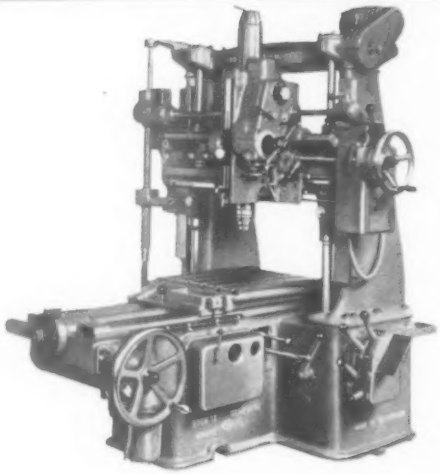

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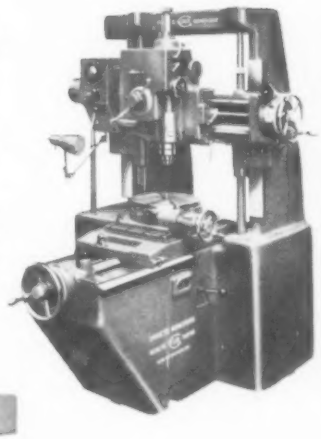

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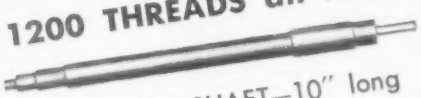

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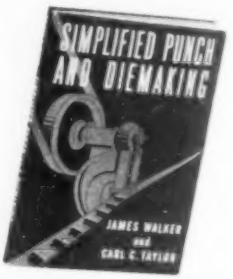

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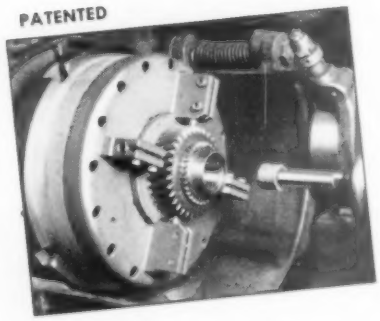

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Index of Tool Engineer Advertisers

March 1947

Ace Drill Corporation ..... Back Cover
Witte & Burden
Acme Industrial Company 120
Edward C. Kennedy
Acme Tool Co. 134
Lipsett Advertising Agency
Allegheny Ludlum Steel Corp. 128
Walker & Downing
The Allen Mfg. Co. 124
Norris L. Bull Advertising
American Chain & Cable Co., Andrew C. Campbell Division 126
Reincke, Meyer & Finn, Inc.
B. C. Ames Company 116
Henry A. Loudon, Advertising

The Baird Machine Co. 96
Baker Brothers, Inc. 12
Beeson-Faller-Reichert, Inc.
Bay State Abrasive Products Co. 109
Howard-Wesson Co.
Bay State Tap & Die Co. 140
Hammond-Goff Co.
Behr-Manning Corp. 98
Hevenor Advertising Agency, Inc.
Charles H. Besley & Co. 119
Evans Associates Co.
Bethlehem Steel Co., Inc. 106
Jones & Brakeley, Inc.
Edward Blake Company 136
Henry A. Loudon, Advertising
Bokum Tool Co. 134
Chas. M. Gray & Associates
Botwinik Bros. of Mass., Inc. 139
C. Jerry Spaulding, Inc.
Boyar-Schultz Corp. ..... 75 & 95
C. W. Munger
Brown & Sharpe Mfg. Co. 97
Horton-Noyes Company
Bryant Chucking Grinder Co. 127
Henry A. Loudon, Advertising

Carboloy Company, Inc. 79
Carborundum Co. 105
Comstock, Duffes & Co.
Casco Products Corp. 116
Grey Advertising Agency, Inc.
Cleveland Twist Drill Co. 99
Belden & Hickox
Columbia Tool Steel Co. 124
R. J. Skala
Continental Tool Works, Div. of Ex-Cell-O Corp. 143
Holden-Clifford-Flint, Inc.
Cosa Corporation 137
Crobalt, Inc. 123
Charles Schweim Co.
Curtis Universal Joint Co., Inc. 120
duPont & Cahalin, Inc.
Cushman Chuck Co. 100
Edward W. Robotham & Co.

Danly Machine Specialties, Inc. 73
Behel & Waldie & Briggs, Inc.
Detroit Die Set Corp. 96
Wolfe-Jickling-Dow & Conkey, Inc.
Detroit Reamer & Tool Co. 86
Dudgeon, Taylor & Bruske, Inc.
Detroit Tap & Tool Co. 114
Denham & Co.
H. E. Dickerman Mfg. Co. 94
The Dykem Company 134

Economy Tool & Machine Co. 88

A. B. Farquhar Co. 89
J. G. Kuester & Associates

Gairing Tool Company 101
R. Marshall Advertising
Gallmeyer & Livingston Co. 8
Wesley Aves & Associates
The Gammons-Hoaglund Co. 92
Gisholt Machine Co. 78
The Buchen Co.
Greenfield Tap & Die Corp. 72
Channing L. Bete Co.
Grob Brothers 124

Hanna Engineering Works 118
Russell T. Gray, Inc.
Hannifin Manufacturing Co. 14
Edwin H. Verrall
Hardinge Brothers, Inc. 3
Taylor Ward, Inc.
Heald Machine Co. 84
Rickard & Co., Inc.
Holo-Krome Screw Corp. 144
R. H. Young & Associates

Ingersoll Milling Machine Co. 115
Cummings, Brand & McPherson
International Nickel Co. 122
Marschalk & Pratt Co.

Charles L. Jarvis Co. 104
Hugh H. Graham & Associates

Kennametal, Inc. 7
W. S. Hill Co.
Kingsbury Machine Tool Corp. 93
Henry A. Loudon, Advertising
Koebel Diamond Tool Co. 142
Holden-Clifford-Flint, Inc.

Landis Machine Co. 108
Langsdale Advertising
Langelier Manufacturing Co. 80
Lavallee & Ide 76
Wm. B. Remington, Inc.
H. Leach Machinery Co. ..... 116 & 120
Joseph Maxfield Co.
Lincoln Electric Co. 71
Griswold-Eshleman Co.
Lincoln Park Industries, Inc. 102
Charles M. Gray & Associates

Macmillan Company 140
Atherton & Currier, Inc.
Merz Engineering Co. 132
Caldwell-Baker Co., Inc.
Metal Carbides Corp. 112
Meek and Thomas, Inc.
Midvale Company 113
Lewis & Gilman, Inc.
Morse Twist Drill & Machine Co. ..... 10 & 11
Sutherland-Abbott

National Automatic Tool Co. 69
Emerson H. Mook
National Broach & Machine Co. 103
Witte & Burden
National Twist Drill & Tool Co. 131
Holden-Clifford-Flint, Inc.

Oilgear Company 125
Kirkgasser-Drew
O. K. Tool Company 91
Peck Brothers

Pioneer Engineering & Mfg. Co. 92
St. Claire Adv. Agency
Pitman Publishing Corp. 92
Pope Machinery Corp. 107
Walter B. Snow & Staff, Inc.
Potter & Johnston Machine Co. 77
Pratt & Whitney ..... Inside Front Cover
Wm. B. Remington, Inc.

Racine Tool & Machine Co. 110
L. W. Ramsey Co.
Ready Tool Company 76
Edward W. Robotham & Co.
Reed Rolled Thread Die Co. 139
Lewis Advertising Agency
Ruthman Machinery Co. 88
Bunker & Downing, Inc.

Screw Machine Tool Co. 121
St. Claire Adv. Agency
Shearcut Tool Co. 129
Larry Pendleton & Associates
Sheffield Corporation ..... Inside Back Cover
Witte & Burden
Sheldon Machine Co., Inc. 136
Ross Llewellyn
Sidney Machine Tool Co. 6
Simonds Saw & Steel Co. 141
Sutherland-Abbott
Snyder Tool & Engineering Co. 138
Wolfe-Jickling-Dow & Conkey, Inc.
South Bend Lathe Works 85
Lamport, Fox, Prell & Dolk, Inc.
Standard Gage Co., Inc. 5
Hevenor Advertising Agency, Inc.
Staples Tool Co. 111
The Keelor & Stites Co.
L. S. Starrett Co. 15
Walter B. Snow & Staff, Inc.
Steinle Machine Co. 13
Stokerunit Corporation 82
Strong, Carlisle & Hammond Co. 94
Fuller & Smith & Ross, Inc.
D. A. Stuart Oil Co., Ltd. 88
Russell T. Gray, Inc.
Super Tool Company 16
Wolfe-Jickling-Dow & Conkey, Inc.
Swartz Tool Products Co., Inc. 80

Tungsten Electric Corp. 83
Thoma & Gill

United States Drill Head Co. 142
The Keelor & Stites Co.
Universal Engineering Co. 135
Seemann & Peters, Inc.

Van Keuren Co. 139
Vascoloy-Ramet Corp. 133
Industrial Advertising Associates
Vickers, Inc. 117
Witte & Burden
Vulcan Tool Co. 4
Chester C. Moreland Co.

Walker-Turner Co., Inc. 87
W. L. Towne
Wall Colmonoy Corp. 74
Rolfe C. Spinning, Inc.
War Assets Administration 90
Fuller & Smith & Ross, Inc.
S. B. Whistler & Sons, Inc. 9
Comstock, Duffes & Co.
Wilson Mechanical Instrument Co. 94
Reincke, Meyer & Finn, Inc.
Winter Brothers Co. 130
Holden-Clifford-Flint, Inc.
Wood & Spencer Co. 132
Scheel Advertising Agency
N. A. Woodworth Co. ..... 81 & 140
A. R. Gloster
C. F. Worfolk 134

W. M. Ziegler Tool Co. 139
Dudgeon, Taylor & Bruske, Inc.

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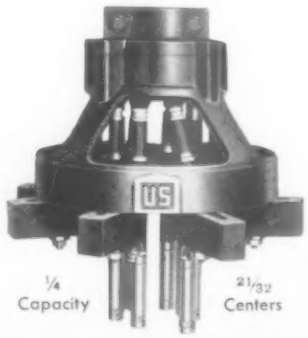

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You can reduce your tool cost, improve accuracy, and increase production with the Continental complete line of standard interchangeable cutting tools. Cutters have a balanced, indestructible drive—originated by Continental—that will not stick, will not break, and is hand detachable.

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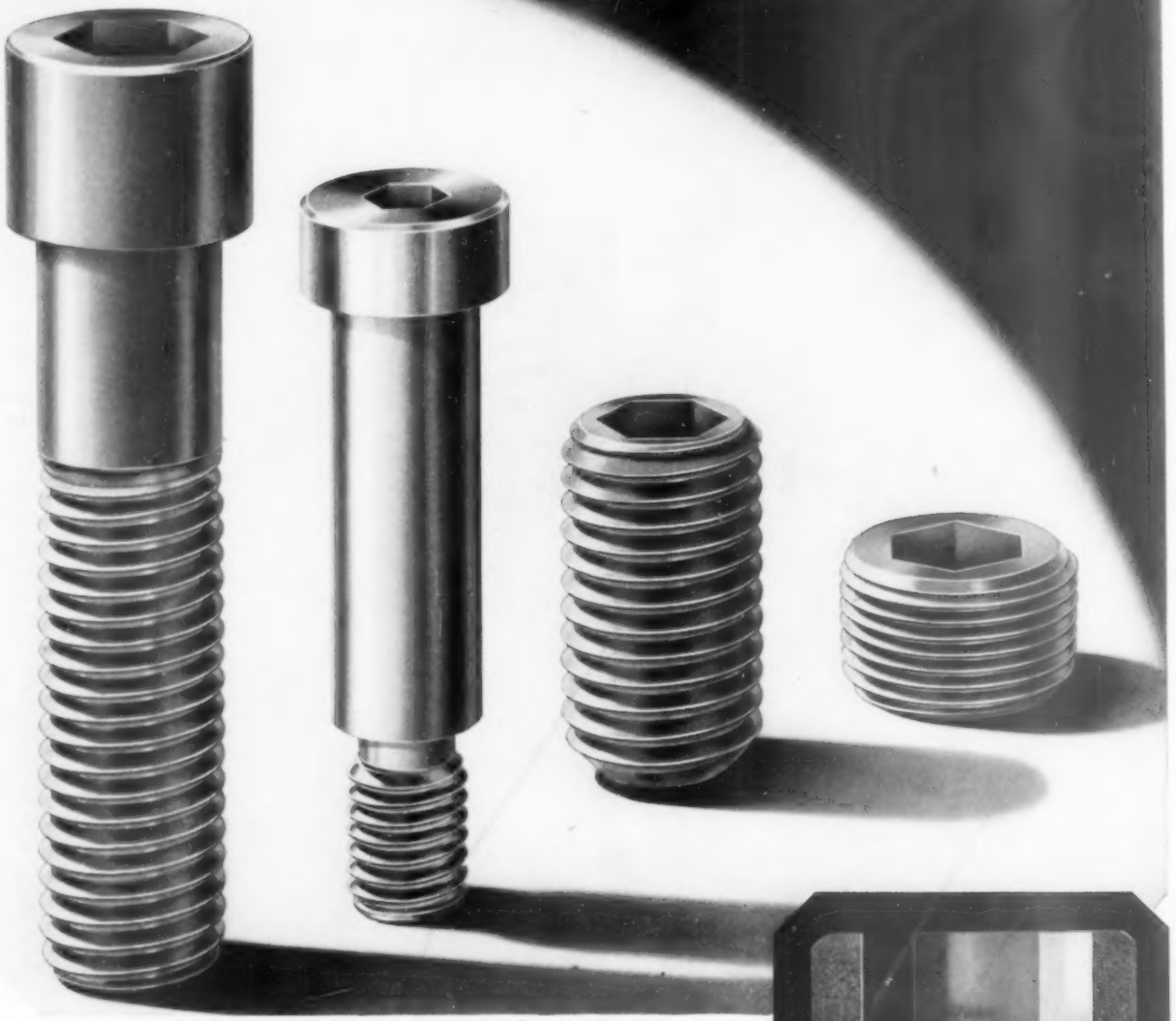
Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

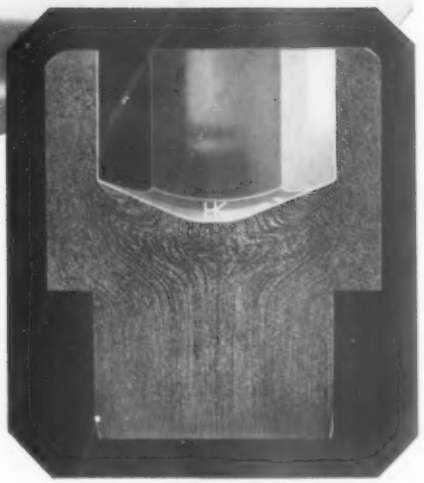
HOLO-KROME *fibro forged* SOCKET SCREWS



THE BETTER FASTENING METHOD

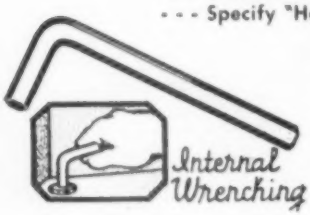
Unseen Quality makes them stronger!

It's the uninterrupted, unbroken and unsevered fibrous structure accomplished exclusively by the Holo-Krome patented method of Completely Cold Forging . . . The results of this exclusive Holo-Krome feature is giving thousands upon thousands of Socket Screw users guaranteed unfailing performance in all types of applications - - - Specify "Holo-Krome".



Unretouched Photo Etched, Cutaway Holo-Krome Socket Head Cap Screw.

YOUR HOLO-KROME INDUSTRIAL DISTRIBUTOR IS READY TO SERVE YOU FROM HIS WAREHOUSE STOCK



THE **HOLO-KROME** SCREW CORPORATION
HARTFORD 10, CONNECTICUT

"Measuring at the Machine"

MINIMIZES PRODUCTION LOSSES!

Reducing production LOSSES means reducing production COSTS. LOSSES usually occur at the machine—stopping such losses brings down costs.

"Measuring at the Machine" brings the following advantages which contribute to being able to sell a product profitably at or under competitive prices:

1. When accurate gaging is practiced right at the production machine, scrap losses have been reduced as much as 80% and 90%.
2. "Measuring at the machine" practically eliminates salvage work which is nearly always costly.
3. Component parts reaching the assembly line fit quickly and easily—no assembly time lost. Instead of working to the high limit as an operator normally does, he works to hit the part "on the nose."
4. When high production gaging instruments like the Multichek, Precisionaire and Visual Gage are used at the machine, the floor space devoted to inspection operations, gage maintenance costs and the labor cost of inspection are all greatly reduced.
5. Under close dimensional control, finished products give maximum performance, greater service life, and help build prestige for the manufacturer.
6. Fewer parts will wear out in service, and then replacement is quickly and easily done —no laborious fitting in the field will be necessary.

SHEFFIELD
MEASTER CRAFTSMEN

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U. S. A.

MACHINE TOOLS...GAGES
MEASURING INSTRUMENTS
CONTRACT SERVICES

ACE uniformly hardened DRILL BLANKS

convenient—

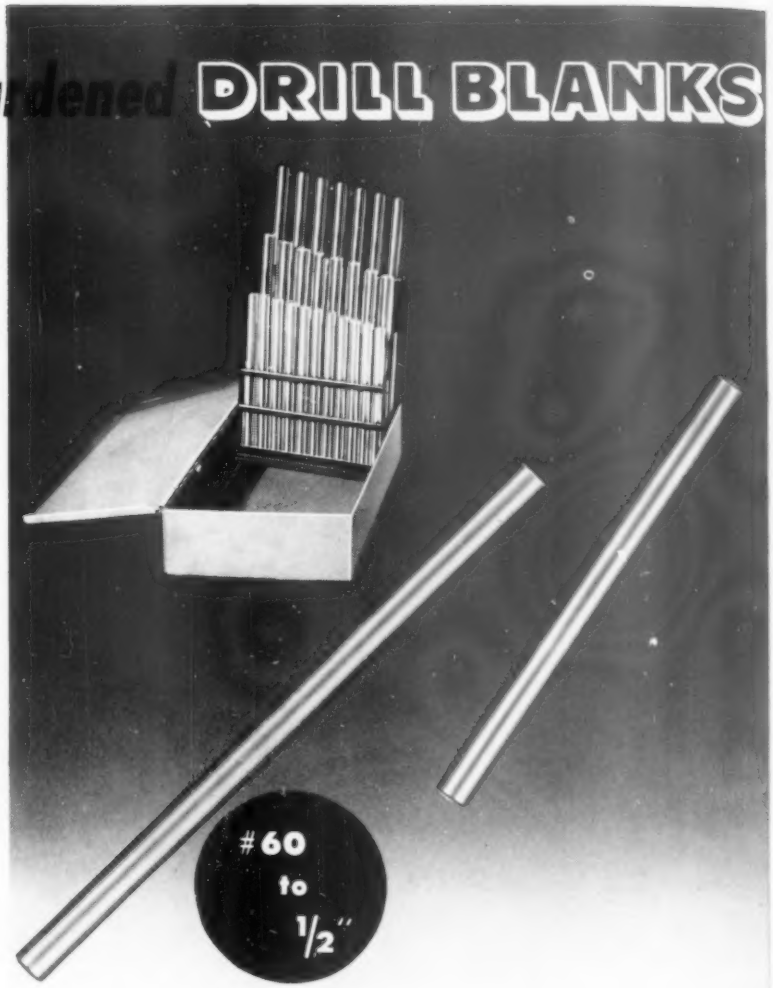
At your finger tips in handy Huot cases. (115 sizes from stock)

adaptable—

Used as end cutting tools, plug gages, punches, etc.

economical—

Wire sizes 1—60 $22.90
Fractional 1/16—1/2 $24.85
Letter Sizes A—Z $22.45



Drill blanks are solid bars of hardened high speed steel, drill length, centerless ground to limits of +.0002"—.0000".

They are used primarily for checking hole sizes and as raw material for fabrication into cutting tools.

Blanks are widely used as inexpensive substitutes for plug gages when a tolerance of .0002" is sufficiently close. Tolerance permitting, they may be used instead of costly gage blocks on many inspection operations.

When closer limits than .0002" are needed these blanks provide the gage maker with a ready medium for lapping to the required tolerance.

Among cutting tool applications are routers, countersinks, spot facers, reamers, end mills, tool bits, boring bar bits and blades for inserted cutters.

Miscellaneous uses include gear tooth gages, thread measuring wires, sine bar settings and punches.

2257

ACE DRILL CORPORATION

MANUFACTURERS OF GROUND-FROM-THE-SOLID DRILLS AND REAMERS